(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 924 897 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
07.04.2010 Bulletin 2010/14

(21) Application number: **06824988.7**

(22) Date of filing: **15.09.2006**

(51) Int Cl.:
G05B 19/042 *(2006.01)*

(86) International application number:
PCT/US2006/036275

(87) International publication number:
WO 2007/035628 (29.03.2007 Gazette 2007/13)

(54) **WAVEFORM SHAPING INTERFACE**

WELLENFORMUNGSSCHNITTSTELLE

INTERFACE DE MODELISATION DE FORMES D'ONDES

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR

(30) Priority: **15.09.2005 US 717784 P**

(43) Date of publication of application:
28.05.2008 Bulletin 2008/22

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Description

BACKGROUND

[0001] The following disclosure is directed to systems that use ejection of fluid droplets.

[0002] In various industries it is useful to deposit a fluid in a controllable manner onto a substrate by ejecting droplets of the fluid from a fluid ejection module. For example, inkjet printing uses a printhead to produce droplets of ink that are deposited on a substrate, such as paper or transparent film, in response to an electronic digital signal, to form an image on the substrate.

[0003] An ink jet printer typically includes an ink path from an ink supply to a printhead that includes nozzles from which ink drops are ejected. Ink drop ejection can be controlled by pressurizing ink in the ink path with an actuator, such as, for example, a piezoelectric deflector, a thermal bubble jet generator, or an electrostatically deflected element. A typical printhead has a line of nozzles with a corresponding array of ink paths and associated actuators, and drop ejection from each nozzle can be independently controlled. In a so-called "drop-on-demand" printhead, each actuator is fired to selectively eject a drop at a specific pixel location of an image, as the printhead and a printing media are moved relative to one another. A high performance printhead may have several hundred nozzles, and the nozzles may have a diameter of 50 microns or less (e.g., 25 microns), may be separated at a pitch of 100-300 nozzles per inch, and may provide drop sizes of approximately 1 to 70 picoliters (p1) or less. Drop ejection frequency is typically 10 kHz or more.

[0004] A printhead can include a semiconductor body and a piezoelectric actuator, for example, the printhead described in Hoisington et al., U.S. Patent No. 5,265,315. The printhead body can be made of silicon, which is etched to define ink chambers. Nozzles can be defined by a separate nozzle plate that is attached to the silicon body. The piezoelectric actuator can have a layer of piezoelectric material that changes geometry, or bends, in response to an applied voltage. The bending of the piezoelectric layer pressurizes ink in a pumping chamber that communicates with a nozzle, and an ink drop is formed.

[0005] Fluid drop formation typically is altered by adjusting the waveform parameters such as voltage amplitude, duration of the voltage pulse, slope of the waveform, number of pulses, and other adjustable parameters of the drive pulse delivered to the piezoelectric actuator. The optimal waveform parameters for different fluids vary depending on a particular fluid's physical properties. Typically, the optimal waveform parameters for a specific fluid are determined empirically. US 6 094 280 A discloses a high-yield printhead where density unevenness is surely corrected taking into consideration various factors related to manufacturing processes of the printhead, a printer utilizing the printhead, and an apparatus and method for correcting print density unevenness by the printhead. According to the method, a plurality of correction tables generated based on the data reflecting the various factors related to manufacturing processes of the printhead are prepared in advance. A test print pattern is printed by using a full-line printhead having a memory for storing correction data, and a tendency of density distribution of the printed pattern image is analyzed. On the basis of the tendency of the density distribution obtained as a result of the analysis, the most appropriate correction table is selected from the plurality of stored correction tables. Then, correction data which is used for suppressing density unevenness is generated on the basis of the selected most appropriate correction table, and the generated correction data is transmitted to the memory of the printhead.

SUMMARY

[0006] The methods, apparatus, and system described here implement techniques for facilitating deposition of fluids of various compositions in a lab deposition system. Specifically, an interactive user interface coupled to a waveform editor facilitates real-time adjustments of waveforms customized for fluids having various compositions.

[0007] In general, in one aspect, the techniques can be implemented in as system that includes a lab deposition system; a waveform editor for facilitating adjustments of various waveform parameters; a user interface to allow interactive adjustments of the waveform parameters; and a camera system in communication with the waveform editor to provide real-time visual feedback of the fluid drop corresponding to the adjustments made by the user.

[0008] The techniques also can be implemented to include one or more of the following features of the user interface. A select pattern window can be implemented to select and load a print pattern from a list of predetermined print patterns. The select pattern window can also be implemented to create custom print patterns. A load/unload substrate window can be implemented to facilitate loading and unloading of a substrate onto a platen of the lab deposition system. A print set-up window can be implemented to print the selected print pattern by initiating fluid drop ejection. A cartridge settings window can be implemented to select a predetermined waveform stored in a file list and adjust the voltage level of the selected waveform for each nozzle. The cartridge settings window can also be implemented to enable a tickle control to prevent fluid from drying and clogging the nozzles. The cartridge settings window can additionally be implemented to adjust a temperature of a cartridge holding the fluid and a meniscus vacuum setting. The cartridge settings window can further be implemented to set the clean cycle for maintaining proper operation of the nozzles. A waveform editor window can be implemented to facilitate the adjustment of various waveform parameters. A drop

watcher window can be implemented to visually inspect fluid drops in real-time.

[0009] The techniques can also be implemented to include one or more of the following features of the waveform editor. Multiple waveform parameters can be adjusted through an user interface presented on the waveform editor window. The adjustable waveform parameters can include voltage level, slew rate, duration, number of segments, frequency, and width of the drive pulse applied to the printhead. The parameters are adjustable for each nozzle, independent of the parameters of other nozzles. In addition, the parameters can be adjusted for a jetting waveform and a non-jetting waveform. The jetting waveform is the drive pulse applied to effect fluid drop ejection from the nozzles. The non-jetting waveform is the drive pulse applied to prevent clogging of the nozzles without effecting fluid drop ejection.

[0010] The techniques can further be implemented to include one or more of the following features of the drop watcher system. A camera can be placed near the printhead to capture video and still images of the fluid drop characteristics for each fluid type. The drop characteristics assessed can at least include size and shape of the drop in addition to the drop speed. The drop watcher system can be implemented in conjunction with the user interface to couple with the waveform editor. The results of the adjustments to the waveform parameters can be immediately seen on a display displaying the video and still images of fluid drops ejecting from each nozzle. Depending on the fluid drop characteristics captured through the drop watcher system, the waveform parameters can be adjusted appropriately in real-time.

[0011] The techniques can be implemented to realize one or more of the following advantages. The waveform editor in combination with the drop watch camera system may enable real-time waveform editing, and thus speed up discovery or development of new liquids with variety of compositions and characteristics. Further, fluids can be tested using a droplet ejection system suitable for small volumes of liquid, permitting valuable test liquids to be conserved, and thus reducing the costs of testing.

[0012] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF DRAWINGS

[0013] FIG. 1 is a block diagram of a lab deposition system.

[0014] FIG. 2 shows a fluid deposition device including a drop watcher camera system.

[0015] FIG. 3 is a block diagram of a graphical user interface.

[0016] FIG. 4 is a representative screenshot of a Print Set-Up interface.

[0017] FIG. 5 is a representative screenshot of a Cartridge Settings interface.

[0018] FIG. 6 is a representative screenshot of a Waveform Editor interface.

[0019] FIG. 7 is a cartoon representation of a waveform.

[0020] FIG. 8 is a schematic diagram of a representative Drop Watcher Viewer.

[0021] FIG. 9 is a representative screenshot of a Cartridge Settings interface.

[0022] FIG. 10 is a representative screenshot of a Cleaning Cycles interface.

[0023] FIG. 11 is a representative screenshot of a Cleaning Cycle Editor.

[0024] FIG. 12 is a representative screenshot of a Select Pattern interface.

[0025] FIG. 13 represents some of the Predetermined Print Patterns stored in a file.

[0026] FIG. 14 is a representative screenshot of a Pattern Editor.

[0027] FIG. 15 is a representative screenshot of a Print Area Preview screen.

[0028] FIG. 16 is a representative screenshot of a Preview Drops screen.

[0029] FIG. 17 is a flowchart of a method of performing real-time waveform editing.

[0030] Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION

[0031] As discussed above, a tremendous variety of liquids with different material compositions are available, and the number of such liquids continues to increase as new materials and compositions are investigated. Liquids may need to be tested for their effectiveness in a proposed application, and droplet ejection conditions may need to be individually determined for optimal deposition of a particular liquid.

[0032] A typical liquid that may need to be tested is ink, and for illustrative purposes, the techniques and droplet ejection modules are described below in reference to a printhead module that uses ink as the liquid. However, it should be understood that other liquids can be used, such as electroluminescent or liquid crystal material used in the manufacture of displays, metal, semiconductor or organic materials used in circuit fabrication, e.g., integrated circuit or circuit board fabrication, and organic, biological, or bioactive materials, e.g., for drugs or the like.

[0033] For example, bioactive materials, such as protein and DNA can be expensive and fragile, requiring special handling techniques. Ink jet technology with non-contact printing process is ideal to provide careful, accurate, and speedy deposition of the bioactive materials in minute drops to not only minimize costs but to speed up reaction processes. A disposable reaction well with hundreds or more of distinct reaction sites can be fabricated as a substrate to facilitate completion of increasingly

higher number of diagnostic tests that could be conducted in parallel. In addition, deposition of bioactive molecules can allow known materials to be applied to substrates in large quantity of molecules to fabricate those molecules in situ using non-contact ink-jet deposition of precursor materials. Oligomeric materials (polymers consisting of two to four monomers) such as DNA and peptides are ideal candidates for ink-jet deposition because DNA and peptides are synthesized using combinatorial synthesis.

[0034] A lab deposition system 10 can be substantially as represented in FIGS. 1-4. Referring to FIG. 1, a block diagram representation of a lab deposition system 10 comprising a fluid deposition device 100 within a housing 110 is shown. In this implementation, the fluid deposition device 100 is coupled to a processor 101. The processor 101 can be connected to a display 103 (*e.g.,* a monitor) and a user input device 105 (*e.g.,* a keyboard and/or mouse). The processor 101 can provide instructions to various components of the fluid deposition device 100, as shall be described further below. The display 103 and user input device 105 can allow a user to input operation parameters and make adjustments to a fluid deposition process, as well as view feedback provided by the processor 101, as described further below.

[0035] Referring to FIG. 2, one embodiment of the fluid deposition device 100 is shown. The fluid deposition device 100 includes a platen 102 configured to support a substrate during a print operation. A cartridge mount assembly 104 is attached to a frame 106 and positioned above the platen 102. The cartridge mount assembly 104 can translate along a rail 108 in the y-direction, providing movement relative to a substrate positioned on the platen 102. Additionally, the cartridge mount assembly 104 can move upward and downward relative to the platen 102, *i.e.,* in the z-direction, to provide relative vertical movement between a print cartridge mounted therein and the substrate.

[0036] In addition, a drop watcher camera system 160 can be mounted to one side of the platen 102. The camera system 160 allows a user to watch fluid drops as they exit the print cartridge 114 and are printed on a substrate positioned in front of the camera system 160. By strobing a light slightly out of phase with the nozzle firing, a series of pictures of a series of fluid drops in flight between the nozzle and the substrate can be obtained. A composite of the series of pictures viewed together can give the illusion of a video clip of a single drop being ejected from a nozzle: in reality, the "video" is actually a composite of a series of still pictures taken of many different drops at slightly different stages of formation and flight. The strobed images can be averaged together to obtain a resultant image or alternatively, each individual image frame can be analyzed to obtain various drop characteristics.

[0037] In some implementations, a high speed video camera is implemented to capture real time video images of the fluid drops being ejected thought one or more nozzles in the print cartridge 114. A high speed video camera can be equipped with a charge-couple device (CCD), complementary-symmetry/metal-oxide semiconductor (CMOS) or other suitable image sensors. A CCD camera can capture images at speeds of up to 1000 frames per second, and this can be increased to 1,000,000 frames per second by adding an image intensifier. An image intensifier is a device that amplifies visible and near-infrared light from an image to facilitate a dimly lit scene to be viewed by a camera. A CMOS sensor can be more cost effective than a CCD sensor and easier to integrate with on-chip memory and processing functions. A CMOS sensor can capture images at speeds of up to 1000 frames per second. Other image sensors capable of similar or higher frame rates can be implemented. The real time video images of the fluid drops can be used to capture various drop characteristics of the fluid drops in various stages of formation and flight. The drop characteristics can be analyzed to provide feedback information to adjust the waveform characteristics of the drive pulse delivered to the print head The adjustments can be performed automatically or manually by a user.

[0038] The display 103 can be used to provide a graphical display to the user of the drops as captured by the camera system 160. Simultaneously, for example, using a split screen or multiple frames within a screen, a graphical representation of a waveform corresponding to the drive pulse to an actuator included in the print cartridge 114 to fire the nozzles can be displayed. The user can view the fluid drops and waveform and make adjustments as desired using the user input device 105. For example, the user can adjust the drive voltage delivered to the printhead within the print cartridge 114, duration of the voltage pulse, slope of the waveform, number of pulses, and other adjustable parameters. The user input is used by the processor 101, *e.g.*, by a software application executing in the processor 101, to adjust the signals sent to the actuator or actuators located within the print cartridge 114.

[0039] In addition, the software application can include a graphical user interface (GUI) 200 comprising multiple interfaces corresponding to one or more lab deposition system functions. FIG. 3 is a block diagram representing one implementation of the GUI 200. A fluid cartridge installation interface 210 can be implemented to facilitate the physical installation of the fluid cartridge by the user. A select pattern interface 220 can be implemented to facilitate user selection of a print pattern from a stored list of predetermined print patterns. The predetermined print patterns can be used to perform test printing of individual fluids on a substrate. A load/unload substrate interface 230 can be implemented to facilitate loading and unloading of the substrate onto the platen 102. The load/unload substrate interface can also be used to facilitate adjustments of temperature and vacuum settings to the platen 102. The vacuum acts to hold the substrate firmly onto the platen during jetting of the fluid, and the temperature adjustment to the platen facilitates creation

of an environment appropriate to temperature sensitive fluids. Jetting of the fluid will not occur until the temperature of the platen reaches the adjusted temperature value. The load/unload substrate interface can further be implemented to facilitate adjustments of the thickness of the substrate. Depending on the thickness of the substrate entered by the user, the cartridge height is automatically adjusted by the lab deposition system 10. A print setup interface 240 can be implemented to facilitate the selection of cartridge settings. Once the cartridge setting is selected by the user, the jetting process can be initiated based on the selected print pattern, substrate settings, and the cartridge settings.

[0040] Jetting of a fluid having specific composition and fluid characteristics requires customization of the cartridge settings. FIG. 4 is a screenshot of one implementation of the GUI 200 comprising an interface window 205 including multiple interfaces accessible through user selection of well known GUI tabs (210, 220, 230, and 240), buttons (250, 260, 270, and 280), and menu buttons 290. In alternate implementations, other GUI components in addition to or in place of the GUI tabs (210, 220, 230, and 240), buttons (250, 260, 270, and 280), and menu button 290 can be used. In the implementation represented in FIG. 4, the user can select an edit button 246 placed next to a cartridge settings selection window 242 to launch a cartridge settings editor 300 as shown in FIG. 5.

[0041] FIG. 5 represents a screenshot of one implementation of the cartridge settings editor 300. The user is presented with three GUI tabs 310, 330, and 350, each tab representing a specific editor interface. User selection of a GUI tab labeled "Waveform" 310 can be implemented to display a waveform level interface 312 to facilitate user selection of a predetermined waveform using a "File" search box 314. A list of predetermined waveforms is stored in a folder to provide template waveforms corresponding to a list of identified liquids. When jetting a new liquid of unknown fluid drop ejection characteristics, the user can start with one of the template waveforms and make necessary adjustments to the waveform as described in the following paragraph below. The waveform level interface 312 can also be implemented to adjust a voltage level for the selected waveform. The voltage level can be adjusted for all nozzles together in equal stepwise increments by allowing the user to enter a voltage increment in a voltage increment input box 316 and selecting an increase/decrease button 318. Alternately, the voltage level can be adjusted individually for each nozzle by allowing the user to enter a voltage level in multiple voltage input boxes 320, one for each nozzle. In addition, the waveform level interface 312 can be implemented to enable a Tickle Control 322 and adjust a frequency 324 of the Tickle Control.

[0042] Once the voltage level has been adjusted by the user, a Waveform Editor 400 as shown in FIG. 6 allows the user to adjust additional waveform parameters. The Waveform Editor 400 can be activated and displayed to the user by a user selection of a "Tools" menu button 326 as shown in FIG. 5 or a "Waveform Editor" button 250 as shown in FIG. 4. A "Jetting Waveform" display 410 and a "Non-Jetting Waveform" display 420 are located on the left side of the Waveform Editor 400. A Jetting Waveform represents a drive pulse applied to the nozzles to effect jetting of a fluid. A Non-Jetting Waveform represents a drive pulse of a lower amplitude than the Jetting Waveform applied to the nozzles to move a meniscus of a fluid drop without effecting jetting of the fluid. Enabling the Tickle Control activates the Non-Jetting Waveform. The user can selectively adjust the waveform parameters for a specific waveform segment by selecting the specific segment of the waveform displayed on the Jetting Waveform display 410 and the Non-Jetting Waveform display 420. User selection of the segment can be performed through a mouse click. Once a segment has been selected by the user, any adjustments of % voltage level 422, slew rate 424, duration 426, slew, frequency 428, and width 430 settings are effected on the selected segment. In addition, segments can be added or deleted by selecting "Add Segment" 432 or "Delete Segment" 434 button.

[0043] The waveform parameters can be adjusted to match the fluid properties of each different liquid. For a thicker liquid of higher viscosity, the voltage level of the waveform needs to be adjusted to a higher level. Likewise, a steeper slew rate, or rise time of the waveform is needed. In general, the higher viscosity fluid is less sensitive and provides for a higher frequency performance. A low viscosity fluid requires a lower voltage, a slower rise time and is more sensitive to drive pulse formation. The low viscosity fluid also does not perform as well at high frequencies. FIG. 7 represents an example waveform 500 comprising four segments 510, 520, 530, and 540. The first two segments 510 and 520 have the most significant impact on the drop velocity and formation. The basic strategy to obtain good drop velocity and good drop formation is to set the voltage to a relatively high level while visually inspecting that the drop formation is acceptable. The drop watcher camera system 160 mounted to one side of the platen 102 can be used to observe the drop formation from the nozzles. Then, based on the visual inspection of the drop formation, the first two segments 510 and 520 can be adjusted. The focus is to obtain higher drop velocities while maintaining good drop formation. Reducing the voltage can improve the drop formation, and small adjustments of the last two segments 530 and 540 can provide further improvements in drop formation.

[0044] Still images and video images of drop formation captured by the drop watcher camera system 160 can be displayed to the user through a Drop Watcher Viewer 600 as shown in FIG. 8. A user selection of a "Drop Watcher" button 260 can activate the display of the Drop Watcher Viewer 600. In one embodiment, the Waveform Editor and the Drop Watcher Viewer are provided and displayed to the user simultaneously in order to facilitate

the customization of a waveform specific for a given fluid. This allows the user to perform real-time adjustments to the waveform as describe above. The Drop Watcher Viewer 600 can allow the user to see the nozzles of the cartridge, the nozzle surface, and watch jetting of the fluid. The user can select each nozzle to visually inspect firing of each nozzle. A mouse click on a desired nozzle fires the nozzle or turns the nozzle off. There are also two arrow buttons (610 and 620) near the bottom left of the screen which allow you to focus the drop watcher camera system on a nozzle and drops ejected from the nozzle. Alternatively or in addition, the system can include automated or semi-automated intelligence (e.g. implemented as one or more algorithms in software and/or hardware) to control adjustment of the waveform. For example, an automated (without user input) or semi-automated (with at least some user input) algorithm could apply visual object recognition techniques to the camera output to determine properties of the drops being output by the deposition system, and then adjust the firing waveform automatically based on predetermined criteria.

[0045] The system provides the user with two different viewing modes. A mouse click on Movie Mode button 630 allows the user to watch the drops in flight as they are ejected from the nozzle. If Movie Mode is not selected the user can "freeze" the drop in flight for closer inspection and measurement. By adjusting the strobe delay, the user can freeze the drop at different positions after it leaves the nozzle. A velocity measurement can be performed by setting the strobe delay to 100 μsec while not in Movie Mode. This allows the drop to be captured 100 μsec after the fire pulse. By selecting the Graticle scale from the Tools menu button 326 on the Drop Watch Viewer, a scale is displayed on the screen electrically. The user can mouse click on the nozzle and drag it to the O line of the scale to determine the distance traveled by the drop in 100 μsec. This rate measurement in μm per μsec can be converted to m per sec. Similar velocity measurements can be performed for each nozzle by mouse clicking on the various nozzles. Other versions of the scale can also be implemented in the Tools menu button.

[0046] Referring back to FIG. 5, a user selection of the next GUI tab, "Cartridge," 330 launches a Cartridge Settings interface 332 (FIG. 9). As described above, if a viscosity of a fluid in the cartridge is too high, the interface can be implemented to adjust the cartridge temperature to a higher level by allowing the user to enter a desired temperature in the cartridge temperature input box 334. An increase in the cartridge temperature effectively increases the temperature of the fluid in the cartridge and decreases the viscosity of the fluid.

[0047] User selection of a "Cleaning Cycles" tab 350 can launch a Cleaning Cycles Interface 700 (FIG. 10) to allow the user to set cartridge maintenance profiles for printing. The user can selected a predetermined Cleaning Cycle to run at the Start of Printing 702, During Printing 704, End of Printing 706, and While Printing 708 using the corresponding file select windows. In addition, the user can select frequency (712 and 714) of the clean cycle running During Printing and While Idle. Some fluids do not need maintenance while others need a high amount of maintenance to keep the nozzles clear and functioning properly. Keeping the nozzles clear can include pushing the fluid through the nozzles to remove air bubbles. FIG. 11 represents a Cleaning Cycle Editor 750 for editing existing cleaning cycle parameters and creating new cleaning cycles. The user can launch the Cleaning Cycle Editor through the Tools menu button 710. A cleaning cycle can be very simple such as a "2 second Blot" where the carriage simply goes to the cleaning station and "Blots" the cartridge with the cleaning pad. The cleaning cycle can also be several actions long. To create a Cleaning Cycle, the user can click on the "Spit" 752, "Purge" 754, or "Blot" 756 buttons. Then the user can enter a number or use the arrows for the "Time" 758, Frequency" 760 or "Post Delay" 762 input boxes. Clicking on the "Add" button 764 will enter the clean cycle into a table 766. The user created Cleaning Cycle can be saved by selecting the "File" menu button 768. Appropriate file name describing the parameters should be given for each stored Cleaning Cycle, to facilitate identification at a future time. A mouse click of the "Run Now" button 770 executes the selected Clean Cycle.

[0048] Referring back to FIG. 5, the Select Pattern tab 220 can be selected by a mouse click to activate a Select Pattern Interface 800 for creating new print patterns or editing existing print patterns. FIG. 12 displays a screenshot of the Select pattern Interface 800 comprising a "Select" button 810 for selecting predetermined print patterned stored in a file and a "Edit" button 820 for editing a predetermined print pattern or creating a new print pattern. FIG. 13 is a representative list of possible predetermined print patterns 815. The user can create a new print pattern by mouse clicking on the Edit button 820 and activating the Pattern Editor 830 (FIG. 14). The Substrate edit area 840 can allow the user to edit the "Dimensions" or the total print area by entering a value into a Width box 842 and a Height box 844. Generally jetting is performed on only a single substrate, but a user could place several smaller substrates on the platen and jet on them at once. For example, when jetting biological fluids such as DNA, the substrate could be a collection of multiple wells for jetting small volume of DNA into each well to conduct multiple reaction processes. The user can mouse click on a Print Area Preview button 846 to launch a pop up window 848 (FIG. 15) showing the user designated area. The total area of the window represents the platen 102. If the substrate is smaller than the platen it will show as a beige shape Substrate area 849 inside a white area. The user can then make the necessary adjustments based on the displayed print area.

[0049] Located below the Substrate edit area 840 can be a Pattern Block Edit area 850, which allows the user to specify a Pattern Block area delineated within the Substrate area. In the Pattern Block edit area 850, the user can enter a starting point of a pattern area in X-Y coor-

dinates 852. A Width 854 and Length 856 can also be specified to designate the total area of the pattern. Multiples of the same pattern in the user designated print area can be printed by entering a spacing between each pattern in X-Separation 858 and Y-Separation 860 boxes, and the number of patterns to print in the horizontal direction (X Count 862) and in the vertical direction (Y Count 864). The DNA jetting application describe above could also be applicable here.

[0050] The third Pattern Editing area can be a Pattern Block Drop Position area 870 to designate a starting point of the pattern and features of the pattern. In the Pattern Block Drop ' Position area 870, the user can enter the position in X-Y coordinates 872 of a first fluid drop location in the Pattern. The user can also enter a Width 874 and Height 876 of a feature of the pattern. For a 10 mm horizontal line having a thickness of 200 microns, the user can enter the length in the x direction (X Width = 10 mm) and the width in the y direction (Y Height = 200 microns). For the same vertical line, X Width = 200 micron X and Y Height = 10 mm. Thus the pattern generated can be in rectangles of X width and Y height. The user can enter the dimensions for the feature in the appropriate boxes and mouse click on the Add button 878 to placed them in a Table 880. The user can mouse click on a Preview Drops button 882 to launch a pop up window 884 (FIG. 16) to display the designated pattern. The user can click on a line of data in the Table 880 specifying a feature, and that feature will show up as red spot 886 on the Preview drops window 884. The user can Zoom in and out on the feature to see the individual spots. The user can also highlight a line in the Table 880 and mouse click on a Add button 878 to duplicate that feature. The duplicated feature will be jetted right on top of the original feature unless the X-Y start coordinates 872 are adjusted in the appropriate boxes. Referring back to the Substrate edit area 840, a Grid Spacing 890 is the X-Y distance between the drops jetted to create a pattern. For example, with a 50 micron Grid Spacing, the drops will be jetted 50 microns apart in X and 50 microns apart in Y to create the pattern. So, for a 100 micron wide, 10 mm tall vertical line, the system will place 3 drops in the X direction (one for the first edge, another at 50 micron, and another at 100 microns for the next edge) by 2,000 tall.

[0051] Figure 17 is a flow diagram summarizing a method of facilitating adjustments to the waveform parameters. In the first step 910, a drive pulse is applied to the plurality of nozzles. The amplitude of the drive pulse should be sufficiently large to effect fluid drop ejection. In the second step 920, the drop watcher camera system captures real-time images of the drop formations of the fluid from user selected nozzles. Depending on the elemental composition and drop formations and characteristics, one or more of the waveform parameters need to be adjusted to optimize fluid drop ejection. In the third step 930, the user reviews the real-time images of fluid drops ejected from the nozzles and adjusts appropriate waveform parameters.

[0052] A number of references to functions that can be executed to by the processor 101 are described above. It should be understood that more than one processor can be used, and reference to processor 101 is exemplary. Additionally, in one implementation, a user input device can be mounted directly onto the fluid deposition device 100, for example, as a touch pad and/or screen. Other forms of user input devices can also be used.

[0053] Embodiments of the subject matter and the functional operations described in this specification can be implemented in digital electronic circuitry, or in computer software, firmware, or hardware, including the structures disclosed in this specification and their structural equivalents, or in combinations of one or more of them. Embodiments of the subject matter described in this specification can be implemented as one or more computer program products, i.e., one or more modules of computer program instructions encoded on a tangible program carrier for execution by, or to control the operation of, data processing apparatus.

The tangible program carrier can be a propagated signal or a computer readable medium. The propagated signal is an artificially generated signal, e.g., a machine-generated electrical, optical, or electromagnetic signal, that is generated to encode information for transmission to suitable receiver apparatus for execution by a computer. The computer readable medium can be a machine-readable storage device, a machine-readable storage substrate, a memory device, a composition of matter effecting a machine-readable propagated signal, or a combination of one or more of them.

[0054] The term "data processing apparatus" encompasses all apparatus, devices, and machines for processing data, including by way of example a programmable processor, a computer, or multiple processors or computers. The apparatus can include, in addition to hardware, code that creates an execution environment for the computer program in question, e.g., code that constitutes processor firmware, a protocol stack, a database management system, an operating system, or a combination of one or more of them.

[0055] A computer program (also known as a program, software, software application, script, or code) can be written in any form of programming language, including compiled or interpreted languages, or declarative or procedural languages, and it can be deployed in any form, including as a stand alone program or as a module, component, subroutine, or other unit suitable for use in a computing environment. A computer program does not necessarily correspond to a file in a file system. A program can be stored in a portion of a file that holds other programs or data (e.g., one or more scripts stored in a markup language document), in a single file dedicated to the program in question, or in multiple coordinated files (e.g., files that store one or more modules, sub programs, or portions of code). A computer program can be deployed to be executed on one computer or on multiple computers that are located at one site or distributed

across multiple sites and interconnected by a communication network.

[0056] The processes and logic flows described in this specification can be performed by one or more programmable processors executing one or more computer programs to perform functions by operating on input data and generating output. The processes and logic flows can also be performed by, and apparatus can also be implemented as, special purpose logic circuitry, e.g., an FPGA (field programmable gate array) or an ASIC (application specific integrated circuit).

[0057] Processors suitable for the execution of a computer program include, by way of example, both general and special purpose microprocessors, and any one or more processors of any kind of digital computer. Generally, a processor will receive instructions and data from a read only memory or a random access memory or both. The essential elements of a computer are a processor for performing instructions and one or more memory devices for storing instructions and data. Generally, a computer will also include, or be operatively coupled to receive data from or transfer data to, or both, one or more mass storage devices for storing data, e.g., magnetic, magneto optical disks, or optical disks. However, a computer need not have such devices. Moreover, a computer can be embedded in another device, e.g., a mobile telephone, a personal digital assistant (PDA), a mobile audio or video player, a game console, a Global Positioning System (GPS) receiver, to name just a few.

[0058] Computer readable media suitable for storing computer program instructions and data include all forms of non volatile memory, media and memory devices, including by way of example semiconductor memory devices, e.g., EPROM, EEPROM, and flash memory devices; magnetic disks, e.g., internal hard disks or removable disks; magneto optical disks; and CD ROM and DVD-ROM disks. The processor and the memory can be supplemented by, or incorporated in, special purpose logic circuitry.

[0059] To provide for interaction with a user, embodiments of the subject matter described in this specification can be implemented on a computer having a display device, e.g., a CRT (cathode ray tube) or LCD (liquid crystal display) monitor, for displaying information to the user and a keyboard and a pointing device, e.g., a mouse or a trackball, by which the user can provide input to the computer. Other kinds of devices can be used to provide for interaction with a user as well; for example, input from the user can be received in any form, including acoustic, speech, or tactile input.

[0060] Embodiments of the subject matter described in this specification can be implemented in a computing system that includes a back end component, e.g., as a data server, or that includes a middleware component, e.g., an application server, or that includes a front end component, e.g., a client computer having a graphical user interface or a Web browser through which a user can interact with an implementation of the subject matter described is this specification, or any combination of one or more such back end, middleware, or front end components. The components of the system can be interconnected by any form or medium of digital data communication, e.g., a communication network. Examples of communication networks include a local area network ("LAN") and a wide area network ("WAN"), e.g., the Internet.

[0061] The computing system can include clients and servers. A client and server are generally remote from each other and typically interact through a communication network. The relationship of client and server arises by virtue of computer programs running on the respective computers and having a client-server relationship to each other.

[0062] While this specification contains many specifics, these should not be construed as limitations on the scope of any invention or of what may be claimed, but rather as descriptions of features that may be specific to particular embodiments of particular inventions. Certain features that are described in this specification in the context of separate embodiments can also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment can also be implemented in multiple embodiments separately or in any suitable subcombination. Moreover, although features may be described above as acting in certain combinations and even initially claimed as such, one or more features from a claimed combination can in some cases be excised from the combination, and the claimed combination may be directed to a subcombination or variation of a subcombination.

[0063] Similarly, while operations are depicted in the drawings in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Moreover, the separation of various system components in the embodiments described above should not be understood as requiring such separation in all embodiments, and it should be understood that the described program components and systems can generally be integrated together in a single software product or packaged into multiple software products.

[0064] A number of embodiments have been described. Other embodiments are within the scope of the following claims.

Claims

1. A system comprising:

a computer system configured to control a lab deposition system including a plurality of nozzles;
a graphical user interface (400) to the computer

system, the graphical user interface configured to control waveform parameters that affect jetting of at least a first fluid through at least a first nozzle, the graphical user interface enabling a user to adjust a plurality of waveform parameters of a first drive pulses delivered to the first nozzles; and
a camera (160) communicatively coupled to the lab deposition system, the camera configured to provide real-time feedback information of at least the first fluid ejected through the first nozzle; and
the graphical user interface further comprising:

a waveform editor (400) configured to adjust the waveform parameters; and
a drop watcher (600) communicatively coupled to the camera and the waveform editor, the drop watcher (600) configured to display real-time still images and video images of the first fluid jetting through the first nozzle.

2. The system of claim 1, wherein the waveform parameters comprise at least one of a voltage level, a slew rate, a duration, a plurality of segments, a frequency, and a width of the first drive pulse delivered to the first nozzle.

3. The system of claim 2, wherein the waveform editor is further configured to adjust the voltage level of the first drive pulse in step-wise increments.

4. The system of claim 1, wherein the first drive pulse comprises a jetting waveform and a non-jetting waveform.

5. The system of claim 4, wherein the waveform editor is further configured to adjust the non-jetting waveform by applying a low amplitude pulse to the first nozzle to move a meniscus of a fluid drop of the first fluid without ejecting the fluid drop.

6. The system of claim 1, wherein the waveform editor is further configured to adjust the waveform parameters to add or subtract waveform segments.

7. The system of claim 1, wherein the graphical user interface is further configured to provide the waveform editor and the drop watcher simultaneously to a user.

8. The system of claim 1, wherein the graphical user interface further comprises: a cartridge install interface configured to provide information to execute physical installation of a fluid cartridge; a print pattern selection interface configured to select a predetermined print pattern; a substrate load/unload interface configured to load or unload a substrate; and a print setup interface configured to adjust cartridge settings.

9. The system of claim 1, further comprising a storage unit communicatively coupled to the computer system, the storage unit configured to store a plurality of predetermined drive pulses; and wherein the waveform editor is further configured to select one of the stored predetermined drive pulses.

10. The system of claim 8, wherein the substrate load/unload interface is further configured to receive user adjustment of at least one of a platen temperature and a substrate thickness, and to enable or disable a platen vacuum.

11. The system of claim 8, wherein the print setup interface is further configured to adjust a cartridge temperature.

12. The system of claim 8, wherein the print setup interface is further configured to create and adjust one or more cleaning cycles to perform maintenance of the first nozzle.

13. The system of claim 8, wherein the print pattern selection interface further comprises a pattern editor configured to adjust a first predetermined pattern or create a new pattern.

14. The system of claim 13, wherein the pattern editor is further configured to adjust at least one of a substrate height, a substrate width, a pattern block starting X- coordinate, a pattern block starting Y-coordinate, a pattern block height, a pattern block width, a pattern block drop position starting X-coordinate, a pattern block drop position Y- coordinate, a pattern block drop position height, and a pattern block drop position width.

15. A system of claim 1, wherein the graphical user interface is configured to control jetting of a second fluid through a second nozzle.

16. A method comprising:

providing a graphical user interface on a computer system, the graphical user interface configured to control waveform parameters that affect jetting of fluids through a plurality of nozzles;
applying a first drive pulse to a first nozzle to effect jetting of a first fluid through the first nozzle;
capturing a real-time visual feedback information of the first fluid being ejected through the first nozzle, wherein capturing the real-time visual feedback information comprises capturing still images and video images of the first fluid

jetting through the first nozzle; and
adjusting a plurality of waveform parameters of the first drive pulse delivered to the first nozzle to control jetting of the first fluid through the first nozzle based on the captured visual feedback information.

17. The method of claim 16, wherein adjusting the waveform parameters comprises adjusting at least one of a voltage level, a slew rate, a duration, a plurality of segments, a frequency, and a width of the first drive pulse applied to the first nozzle.

18. The method of claim 17, wherein adjusting the waveform parameters further comprises adjusting the voltage level of the first drive pulse applied to the first nozzle in stepwise increments.

19. The method of claim 16, wherein adjusting the waveform parameters further comprises adjusting the waveform parameters of a jetting waveform and a non-jetting waveform.

20. The method of claim 19, wherein adjusting the waveform parameters of the non-jetting waveform further comprises applying a low amplitude pulse to the first nozzle to move a meniscus of a fluid drop of the first fluid without ejecting the fluid drop.

21. The method of claim 16, wherein adjusting the waveform parameters further comprises adding or subtracting waveform segments to the first drive pulse.

22. The method of claim 16, wherein providing the graphical user interface further comprises: providing a guide for physically installing a fluid cartridge through a cartridge install interface; selecting a predetermined print pattern using a print pattern selection interface; loading or unloading a substrate using a substrate load/unload interface; and adjusting cartridge settings using a print setup interface.

23. The method of claim 16, further comprises providing a storage unit for storing a plurality of predetermined drive pulses; and wherein adjusting the plurality of waveform parameters further comprises selecting the first drive pulse from the predetermined drive pulses stored in the storage unit.

24. The method of claim 22, wherein loading or unloading a substrate further comprises adjusting a platen temperature and a substrate thickness and enabling or disabling a platen vacuum.

25. The method of claim 22, wherein adjusting the cartridge settings further comprises adjusting a cartridge temperature.

26. The method of claim 22, wherein adjusting the cartridge settings further comprises creating or adjusting one or more cleaning cycles to perform maintenance of the first nozzle.

27. The method of claim 22, wherein adjusting the cartridge settings further comprises editing a predetermined print pattern or creating a new print pattern.

28. The method of claim 27, wherein editing the predetermined print pattern or creating the new print pattern further comprises adjusting at least one of a substrate height, a substrate width, a pattern block starting X-coordinate, a pattern block starting Y-coordinate, a pattern block height, a pattern block width, a pattern block drop position, starting X-coordinate, a pattern block drop position Y-coordinate, a pattern block drop position height, and a pattern block drop position width.

29. The method of claim 16, further comprising: applying a second drive pulse to a second nozzle to effect jetting of a second fluid through the second nozzle; capturing real-time visual feedback information of the second fluid being ejected through the second nozzle; and adjusting a plurality of waveform parameters of the second drive pulse delivered to the second nozzle to control jetting of the second fluid through the second nozzle based on the captured visual feedback information.

30. A computer program product encoded on a computer-readable medium, operable to cause data processing apparatus to perform operations comprising:

executing a graphical user interface on a computer system, the graphical user interface configured to control waveform parameters that affect jetting of a plurality of fluids through a plurality of nozzles;
applying a first drive pulse to a first nozzle to effect jetting of a fluid through the first nozzle;
capturing real-time visual feedback information of the first fluid being ejected through the first nozzle, wherein capturing the real-time visual feedback information comprises capturing still images and video images of the first fluid jetting through the first nozzle; and
adjusting a plurality of waveform parameters of the first drive pulse delivered to the first nozzle to control jetting of the first fluid through the first nozzle based on the captured visual feedback information.

31. The product of claim 30, further operable to cause data processing apparatus to perform operations comprising adjusting at least one of a voltage level,

a slew rate, a duration, a plurality of segments, a frequency, and a width of the first drive pulse applied to the first nozzle.

32. The product of claim 30, further operable to cause data processing apparatus to perform operations comprising adjusting the voltage level of the first drive pulse applied to the first nozzle in step-wise increments.

33. The product of claim 30, further operable to cause data processing apparatus to perform operations comprising adjusting the waveform parameters of a jetting waveform and a non-jetting waveform of the first drive pulse.

34. The product of claim 33, further operable to cause data processing apparatus to perform operations comprising adjusting the waveform parameters of the non-jetting waveform by applying a low amplitude pulse to the first nozzle to move a meniscus of a fluid drop of the first fluid without ejecting the fluid drop.

35. The product of claim 30, further operable to cause data processing apparatus to perform operations comprising adding or subtracting waveforms segments to the first drive pulse.

36. The product of claim 30, further operable to cause data processing apparatus to perform operations comprising: providing a guide for physically installing a fluid cartridge through a cartridge install interface; selecting a predetermined print pattern using a print pattern selection interface; loading or unloading a substrate using a substrate load/unload interface; and adjusting cartridge settings using a print setup interface.

37. The product of claim 30, further operable to cause data processing apparatus to perform operations comprising storing a plurality of predetermined drive pulses; and selecting the first drive pulse from the predetermined drive pulses stored in the storage unit.

38. The product of claim 36, further operable to cause data processing apparatus to perform operations comprising loading or unloading a substrate including adjusting a platen temperature and a substrate thickness and enabling or disabling a platen vacuum.

39. The product of claim 36, further operable to cause data processing apparatus to perform operations comprising adjusting the cartridge settings including adjusting a cartridge temperature.

40. The product of claim 36, further operable to cause data processing apparatus to perform operations comprising adjusting the cartridge settings including creating or adjusting one or more cleaning cycles to perform maintenance of the first nozzle.

41. The product of claim 36, further operable to cause data processing apparatus to perform operations comprising adjusting the cartridge settings including editing a predetermined print pattern or creating a new print pattern.

42. The product of claim 37, further operable to cause data processing apparatus to perform operations comprising editing the predetermined print pattern or creating the new print pattern including adjusting at least one of a substrate height, a substrate width, a pattern block starting X-coordinate, a pattern block starting Y-coordinate, a pattern block height, a pattern block width, a pattern block drop position starting X-coordinate, a pattern block drop position Y-coordinate, a pattern block drop position height, and a pattern block drop position width.

43. The product of claim 30, further operable to cause data processing apparatus to perform operations comprising: applying a second drive pulse to a second nozzle to effect jetting of a second fluid through the second nozzle; capturing real-time visual feedback information of the second fluid being ejected through the second nozzle; and adjusting a plurality of waveform parameters of the second drive pulse delivered to the second nozzle to control jetting of the second fluid through the second nozzle based on the captured visual feedback information.

Patentansprüche

1. System umfassend:

ein Computersystem, welches konfiguriert ist zum Steuern eines Laborabscheidungssystems einschließlich einer Mehrzahl von Düsen;
eine grafische Benutzerschnittstelle (400) an dem Computersystem, wobei die grafische Benutzerschnittstelle konfiguriert ist zum Steuern von Wellenformparametern, welche Strahlbildung mindestens eines ersten Fluids durch mindestens eine erste Düse beeinflussen, wobei die grafische Benutzerschnittstelle einem Benutzer erlaubt, eine Mehrzahl von Wellenformparametern eines ersten Ansteuerungsimpulses, welcher zu den ersten Düsen geliefert wird, anzupassen; und
eine Kamera (160), welche mit dem Laborabscheidungssystem kommunikativ gekoppelt ist, wobei die Kamera konfiguriert ist zum Bereitstellen von Rückinformation in Echtzeit mindestens des ersten Fluids, welches durch die erste

Düse ausgestoßen wird; und
die grafische Benutzerschnittstelle weiterhin umfassend:

einen Wellenformeditor (400), welcher konfiguriert ist zum Anpassen der Wellenformparameter; und
einen Tropfenüberwacher (600), welcher an die Kamera und den Wellenformeditor kommunikativ gekoppelt ist, wobei der Tropfenüberwacher (600) konfiguriert ist zum Anzeigen von Standbildern und Videobildern in Echtzeit der Strahlbildung des ersten Fluids durch die erste Düse.

2. System nach Anspruch 1, wobei die Wellenformparameter mindestens eines ausgewählt aus einem Spannungsniveau, einer Flankensteilheit, einer Dauer, einer Mehrzahl von Segmenten, einer Frequenz und einer Breite des ersten Ansteuerungsimpulses, welcher zu der ersten Düse geliefert wird, umfassen.

3. System nach Anspruch 2, wobei der Wellenformeditor weiterhin konfiguriert ist zum Anpassen des Spannungsniveaus des ersten Ansteuerungsimpulses in stufenartigen Erhöhungen.

4. System nach Anspruch 1, wobei der erste Ansteuerungsimpuls eine Strahlbildungswellenform und eine Nichtstrahlbildungswellenform umfasst.

5. System nach Anspruch 4, wobei der Wellenformeditor weiterhin konfiguriert ist zum Anpassen der Nichtstrahlbildungswellenform durch Anbringen eines Impulses niedriger Amplitude an die erste Düse, um einen Meniskus eines ersten Fluidtropfens des ersten Fluids ohne Ausstoßen des ersten Tropfens zu bewegen.

6. System nach Anspruch 1, wobei der Wellenformeditor weiterhin konfiguriert ist zum Anpassen der Wellenformparameter, um Wellenformsegmente hinzuzufügen oder abzuziehen.

7. System nach Anspruch 1, wobei die grafische Benutzerschnittstelle weiterhin konfiguriert ist zum gleichzeitigen Bereitstellen des Wellenformeditors und des Tropfenüberwachers an einen Benutzer.

8. System nach Anspruch 1, wobei die grafische Benutzerschnittstelle weiterhin umfasst: eine Patroneneinsetzschnittstelle, welche konfiguriert ist zum Bereitstellen von Information, um das physische Einsetzen einer Fluidpatrone auszuführen; eine Druckmusterauswahlschnittstelle, welche konfiguriert ist zum Auswählen eines vorbestimmten Druckmusters; eine Substratbelade-/-entladeschnittstelle, welche konfiguriert ist zum Beladen oder Entladen eines Substrats; und eine Druckeinrichtungsschnittstelle, welche konfiguriert ist zum Anpassen von Patroneneinstellungen.

9. System nach Anspruch 1, weiterhin umfassend eine Speichereinheit, welche an das Computersystem kommunikativ gekoppelt ist, wobei die Speichereinheit konfiguriert ist zum Speichern einer Mehrzahl von vorbestimmten Ansteuerungsimpulsen; und wobei der Wellenformeditor weiterhin konfiguriert ist zum Auswählen eines der gespeicherten vorbestimmten Ansteuerungsimpulse.

10. System nach Anspruch 8, wobei die Substratbelade-/-entladeschnittstelle weiterhin konfiguriert ist zum Empfangen einer Benutzeranpassung mindestens eines ausgewählt aus einer Plattentemperatur und einer Substratdicke, um ein Plattenvakuum zu aktivieren oder zu deaktivieren.

11. System nach Anspruch 8, wobei die Druckeinrichtungsschnittstelle weiterhin konfiguriert ist zum Anpassen einer Patronentemperatur.

12. System nach Anspruch 8, wobei die Druckeinrichtungsschnittstelle weiterhin konfiguriert ist zum Erzeugen und Anpassen eines oder mehrerer Reinigungszyklen, um Wartung der ersten Düse auszuführen.

13. System nach Anspruch 8, wobei die Druckmusterauswahlschnittstelle weiterhin einen Mustereditor umfasst, welcher konfiguriert ist zum Anpassen eines ersten vorbestimmten Musters oder zum Erzeugen eines neuen Musters.

14. System nach Anspruch 13, wobei der Mustereditor weiterhin konfiguriert ist zum Anpassen mindestens eines ausgewählt aus einer Substrathöhe, einer Substratbreite, einer Musterblockanfangs-X-Koordinate, einer Musterblockanfangs-Y-Koordinate, einer Musterblockhöhe, einer Musterblockbreite, einer Musterblocktropfenpositionsanfangs- X- Koordinate, einer Musterblocktropfenpositions-Y-Koordinate, einer Musterblocktropfenpositionshöhe und einer Musterblocktropfenpositionsbreite.

15. System nach Anspruch 1, wobei die grafische Benutzerschnittstelle konfiguriert ist zum Steuern der Strahlbildung eines zweiten Fluids durch eine zweite Düse.

16. Verfahren umfassend:

Bereitstellen einer grafischen Benutzerschnittstelle auf einem Computersystem, wobei die grafische Benutzerschnittstelle konfiguriert ist

zum Steuern von Wellenformparametern, welche Strahlbildung von Fluiden durch eine Mehrzahl von Düsen beeinflussen; Anbringen eines ersten Ansteuerungsimpulses an eine erste Düse, um Strahlbildung eines ersten Fluids durch die erste Düse zu bewirken;
Erfassen einer visuellen Rückinformation in Echtzeit des ersten Fluids, welches durch die erste Düse ausgestoßen wird, wobei das Erfassen der visuellen Rückinformation in Echtzeit Erfassen von Standbildern und
Videobildern der Strahlbildung des ersten Fluids durch die erste Düse umfasst; und
Anpassen einer Mehrzahl von Wellenformparametern des ersten Ansteuerungsimpulses, welcher zu der ersten Düse geliefert wird, zum Steuern der Strahlbildung des ersten Fluids durch die erste Düse basierend auf der erfassten visuellen Rückinformation.

17. Verfahren nach Anspruch 16, wobei Anpassen der Wellenformparameter Anpassen mindestens eines ausgewählt aus einem Spannungsniveau, einer Flankensteilheit, einer Dauer, einer Mehrzahl von Segmenten, einer Frequenz und einer Breite des ersten Ansteuerungsimpulses, welcher an der ersten Düse angebracht wird, umfasst.

18. Verfahren nach Anspruch 17, wobei Anpassen der Wellenformparameter weiterhin Anpassen des Spannungsniveaus des ersten Ansteuerungsimpulses umfasst, welcher an der ersten Düse in stufenartigen Erhöhungen angebracht wird.

19. Verfahren nach Anspruch 16, wobei Anpassen der Wellenformparameter weiterhin Anpassen der Wellenformparameter einer Strahlbildungswellenform und einer Nichtstrahlbildungswellenform umfasst.

20. Verfahren nach Anspruch 19, wobei Anpassen der Wellenformparameter der Nichtstrahlbildungswellenform weiterhin Anbringen eines Impulses niedriger Amplitude an die erste Düse umfasst, um einen Meniskus eines Fluidtropfens des ersten Fluids ohne Ausstoßen des Fluidtropfens zu bewegen.

21. Verfahren nach Anspruch 16, wobei Anpassen der Wellenformparameter weiterhin Hinzufügen oder Abziehen von Wellenformsegmenten zu dem ersten Ansteuerungsimpuls umfasst.

22. Verfahren nach Anspruch 16, wobei Bereitstellen der grafischen Benutzerschnittstelle weiterhin umfasst: Bereitstellen einer Führung zum physischen Einsetzen einer Fluidpatrone durch eine Patroneneinsetzschnittstelle; Auswählen eines vorbestimmten Druckmusters unter Verwendung einer Druckmusterauswahlschnittstelle; Beladen oder Entladen eines Substrats unter Verwendung einer Substratbelade-/-entladeschnittstelle; und Anpassen von Patroneneinstellungen unter Benutzung einer Druckeinrichtungsschnittstelle.

23. Verfahren nach Anspruch 16, weiterhin umfassend Bereitstellen einer Speichereinheit zum Speichern einer Mehrzahl von vorbestimmten Ansteuerungsimpulsen; und wobei Anpassen der Mehrzahl von Wellenformparametern weiterhin Auswählen des ersten Ansteuerungsimpulses aus den vorbestimmten Ansteuerungsimpulsen, welche in der Speichereinheit gespeichert sind, umfasst.

24. Verfahren nach Anspruch 22, wobei Beladen oder Entladen eines Substrats weiterhin Anpassen einer Plattentemperatur und einer Substratdicke und Aktivieren oder Deaktivieren eines Plattenvakuums umfasst.

25. Verfahren nach Anspruch 22, wobei Anpassen der Patroneneinstellungen weiterhin Anpassen einer Patronentemperatur umfasst.

26. Verfahren nach Anspruch 22, wobei Anpassen der Patroneneinstellungen weiterhin Erzeugen oder Anpassen einer oder mehrerer Reinigungszyklen umfasst, um Wartung der ersten Düse auszuführen.

27. Verfahren nach Anspruch 22, wobei Anpassen der Patroneneinstellungen weiterhin Editieren eines vorbestimmten Druckmusters oder Erzeugen eines neuen Druckmusters umfasst.

28. Verfahren nach Anspruch 27, wobei Editieren des vorbestimmten Druckmusters oder Erzeugen des neuen Druckmusters weiterhin Anpassen mindestens eines ausgewählt aus einer Substrathöhe, einer Substratbreite, einer Musterblockanfangs-X-Koordinate, einer Musterblockanfangs-Y-Koordinate, einer Musterblockhöhe, einer Musterblockbreite, einer Musterblocktropfenpositionsanfangs-X-Koordinate, einer Musterblocktropfenpositions-Y-Koordinate, einer Musterblocktropfenpositionshöhe, und einer Musterblocktropfenpositionsbreite umfasst.

29. Verfahren nach Anspruch 16, weiterhin umfassend: Anbringen eines zweiten Ansteuerungsimpulses an einer zweiten Düse, um Strahlbildung eines zweiten Fluids durch die zweite Düse zu bewirken; Erfassen einer visuellen Rückinformation in Echtzeit des zweiten Fluids, welches durch die zweite Düse ausgestoßen wird; und Anpassen einer Mehrzahl von Wellenformparametern des zweiten Ansteuerungsimpulses, welcher zu der zweiten Düse geliefert wird, um Strahlbildung des zweiten Fluids durch die zweite Düse basierend auf der erfassten visuellen Rückinformation zu steuern.

30. Computerprogrammprodukt, codiert auf einem computerlesbaren Medium, geeignet zu bewirken, dass eine Datenverarbeitungsvorrichtung Operationen ausführt, umfassend:

Ausführen einer grafischen Benutzerschnittstelle auf einem Computersystem, wobei die grafische Benutzerschnittstelle konfiguriert ist zum Steuern von Wellenformparametern, welche Strahlbildung von Fluiden durch eine Mehrzahl von Düsen beeinflussen;
Anbringen eines ersten Ansteuerungsimpulses an eine erste Düse, um Strahlbildung eines ersten Fluids durch die erste Düse zu bewirken;
Erfassen einer visuellen Rückinformation in Echtzeit des ersten Fluids, welches durch die erste Düse ausgestoßen wird, wobei das Erfassen der visuellen Rückinformation in Echtzeit Erfassen von Standbildern und
Videobildern der Strahlbildung des ersten Fluids durch die erste Düse umfasst; und
Anpassen einer Mehrzahl von Wellenformparametern des ersten Ansteuerungsimpulses, welcher zu der ersten Düse geliefert wird, zum Steuern der Strahlbildung des ersten Fluids durch die erste Düse basierend auf der erfassten visuellen Rückinformation.

31. Produkt nach Anspruch 30, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Anpassen mindestens eines ausgewählt aus einem Spannungsniveau, einer Flankensteilheit, einer Dauer, einer Mehrzahl von Segmenten, einer Frequenz und einer Breite des ersten Ansteuerungsimpulses, welcher an der ersten Düse angebracht wird.

32. Produkt nach Anspruch 30, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Anpassen des Spannungsniveaus des ersten Ansteuerungsimpulses, welcher an der ersten Düse in stufenartigen Erhöhungen angebracht wird.

33. Produkt nach Anspruch 30, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Anpassen der Wellenformparameter einer Strahlbildungswellenform und einer Nichtstrahlbildungswellenform des ersten Ansteuerungsimpulses.

34. Produkt nach Anspruch 33, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Anpassen der Wellenformparameter der Nichtstrahlbildungswellenform durch Anbringen eines Impulses niedriger Amplitude an die erste Düse, um einen Meniskus eines Fluidtropfens des ersten Fluids ohne Ausstoßen des Fluidtropfens zu bewegen.

35. Produkt nach Anspruch 30, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Hinzufügen oder Abziehen von Wellenformsegmenten zu dem ersten Ansteuerungsimpuls.

36. Produkt nach Anspruch 30, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend: Bereitstellen einer Führung zum physischen Einsetzen einer Fluidpatrone durch eine Patroneneinsetzschnittstelle; Auswählen eines vorbestimmten Druckmusters unter Verwendung einer Druckmusterauswahlschnittstelle; Beladen oder Entladen eines Substrats unter Verwendung einer Substratbelade-/-entladeschnittstelle; und Anpassen von Patroneneinstellungen unter Benutzung einer Druckeinrichtungsschnittstelle.

37. Produkt nach Anspruch 30, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Speichern einer Mehrzahl von vorbestimmten Ansteuerungsimpulsen; und Auswählen des ersten Ansteuerungsimpulses aus den vorbestimmten Ansteuerungsimpulsen, welche in der Speichereinheit gespeichert sind.

38. Produkt nach Anspruch 36, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Beladen oder Entladen eines Substrats einschließlich Anpassen einer Plattentemperatur und einer Substratdicke und Aktivieren oder Deaktivieren eines Plattenvakuums.

39. Produkt nach Anspruch 36, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Anpassen der Patroneneinstellungen einschließlich Anpassen einer Patronentemperatur.

40. Produkt nach Anspruch 36, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Anpassen der Patroneneinstellungen einschließlich Erzeugen oder Anpassen einer oder mehrerer Reinigungszyklen, um Wartung der ersten Düse auszuführen.

41. Produkt nach Anspruch 36, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Anpassen der Patroneneinstellungen einschließlich Editieren eines vorbestimmten Druckmusters oder Erzeugen eines neuen Druckmusters.

42. Produkt nach Anspruch 37, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend Editieren des vor-

bestimmten Druckmusters oder Erzeugen des neuen Druckmusters einschließlich Anpassen mindestens eines ausgewählt aus einer Substrathöhe, einer Substratbreite, einer Musterblockanfangs-X-Koordinate, einer Musterblockanfangs-Y-Koordinate, einer Musterblockhöhe, einer Musterblockbreite, einer Musterblocktropfenpositionsanfangs-X-Koordinate, einer Musterblocktropfenpositions-Y-Koordinate, einer Musterblocktropfenpositionshöhe, und einer Musterblocktropfenpositionsbreite.

43. Produkt nach Anspruch 30, weiterhin geeignet, zu bewirken, dass die Datenverarbeitungsvorrichtung Operationen ausführt, umfassend: Anbringen eines zweiten Ansteuerungsimpulses an einer zweiten Düse, um Strahlbildung eines zweiten Fluids durch die zweite Düse zu bewirken; Erfassen einer visuellen Rückinformation in Echtzeit des zweiten Fluids, welches durch die zweite Düse ausgestoßen wird; und Anpassen einer Mehrzahl von Wellenformparametern des zweiten Ansteuerungsimpulses, welcher zu der zweiten Düse geliefert wird, um Strahlbildung des zweiten Fluids durch die zweite Düse basierend auf der erfassten visuellen Rückinformation zu steuern.

Revendications

1. Système comprenant :

- un système d'ordinateurs configuré de manière à commander un système de dépôt de laboratoire, comprenant une pluralité de buses ;
- une interface utilisateur en mode graphique (400) sur le système d'ordinateurs, l'interface utilisateur en mode graphique étant configurée pour commander des paramètres de formes d'onde que affectent la forme des jets d'au moins un premier fluide à travers au moins une première buse, l'interface utilisateur en mode graphique permettant l'ajustement par un utilisateur d'une pluralité de paramètres de formes d'onde d'une première impulsion de pilotage fournie aux premières buses ; et
- une caméra (160) couplée par connexion au système de dépôt de laboratoire, la caméra étant configurée pour produire une information de retour en temps réel sur au moins le premier liquide éjecté par la première buse ; et
l'interface utilisateur en mode graphique comprenant de plus :

- un éditeur de formes d'onde (400) configuré pour ajuster les paramètres de formes d'onde ; et
- un surveillant de gouttes (600), couplé par connexion à la caméra et à l'éditeur de formes d'onde, le surveillant de gouttes (600) étant configuré pour afficher en temps réel des images fixes et des images vidéo du premier liquide projeté en jet par la première buse.

2. Système selon la revendication 1, **caractérisé en ce que** les paramètres de formes d'onde comportent au moins l'un des paramètres suivants : un niveau de tension, une vitesse de variation, une durée, une pluralité de segments, une fréquence et/ou la largeur de la première impulsion de pilotage fournie à la première buse.

3. Système selon la revendication 2, **caractérisé en ce que** l'éditeur de formes d'onde est configuré pour ajuster de plus le niveau de tension de la première impulsion de pilotage par incréments.

4. Système selon la revendication 1, dans lequel la première impulsion de pilotage comporte une forme d'onde de mise en jet et une forme d'onde de non mise en jet.

5. Système selon la revendication 4, **caractérisé en ce que** l'éditeur de formes d'onde est configuré de plus pour ajuster la forme d'onde de non mise en jet en appliquant une impulsion de faible amplitude à la première buse pour déplacer le ménisque d'une goutte de fluide du premier fluide sans éjecter la goutte de fluide.

6. Système selon la revendication 1, **caractérisé en ce que** l'éditeur de formes d'onde est configuré de plus pour ajuster les paramètres de formes d'onde pour additionner ou soustraire des segments de formes d'onde.

7. Système selon la revendication 1, **caractérisé en ce que** l'interface utilisateur en mode graphique est configurée de plus pour produire simultanément l'éditeur de formes d'onde et le surveillant de gouttes à un utilisateur.

8. Système selon la revendication 1, **caractérisé en ce que** l'interface utilisateur en mode graphique : une interface d'installation de cartouche configurée pour fournir une information pour exécuter l'installation physique d'une cartouche de fluide ; une interface de sélection de modèles à imprimer configurer pour sélectionner un modèle à imprimer prédéterminé ; une interface de chargement et/ou de déchargement configurée pour charger et/ou décharger un substrat ; et une interface de réglage d'impression configurée pour ajuster les réglages de cartouche.

9. Système selon la revendication 1, **caractérisé en**

ce que il comporte de plus une unité de stockage couplé de manière à être connectée au système d'ordinateurs, l'unité de stockage étant configurée pour stocker une pluralité d'impulsions de pilotage prédéterminées ; et dans lequel l'éditeur de formes d'onde est configuré de plus de manière à sélectionner l'une des impulsions de pilotage stockées prédéterminées.

10. Système selon la revendication 8, **caractérisé en ce que** l'interface de chargement et/ou de déchargement de substrats est configurée de plus de manière à recevoir un ajustement par l'utilisateur d'au moins une température de platine et une épaisseur de substrat et pour activer ou désactiver un vide de platine.

11. Système selon la revendication 8, **caractérisé en ce que** l'interface de réglage d'impression est configurée de plus de manière à ajuster la température de cartouche.

12. Système selon la revendication 8, **caractérisé en ce que** l'interface de réglage d'impression est configurée de plus pour créer et ajuster au moins un cycles de nettoyage pour exécuter la maintenance de la première buse.

13. Système selon la revendication 8, **caractérisé en ce que** l'interface de sélection de modèle d'impression comporte de plus un éditeur de modèles pour ajuster un premier modèle prédéterminé et/ou pour créer un nouveau modèle.

14. Système selon la revendication 13, **caractérisé en ce que** l'éditeur de modèles est configuré de plus de manière à ajuster au moins une hauteur de substrat, une largeur de substrat, une coordonnée X de démarrage de bloc de modèle, une coordonnée Y de démarrage de bloc de modèle, une hauteur de bloc de modèle, une largeur de bloc de modèle, une coordonnée X de démarrage de goutte pour un bloc de modèle, une coordonnée Y de démarrage de goutte pour un bloc de modèle, , une hauteur de position pour un bloc de modèle et une largeur de position pour un bloc de modèle.

15. Système selon la revendication 1, **caractérisé en ce que** l'interface utilisateur en mode graphique est configurée de manière à commander la mise en jet d'un second fluide au moyen d'une seconde buse.

16. Procédé comprenant :

produire une interface utilisateur en mode graphique sur un système d'ordinateurs, l'interface utilisateur en mode graphique étant configuré pour commander des paramètres de formes d'onde qui affectent la mise en jet de fluides au moyen d'une pluralité de buses ; appliquer une première impulsion de pilotage sur une première buse pour affecter la mise en jet d'un premier fluide par la première buse ;

capturer une information de retour visuel en temps réel du premier fluide qui est éjectée par la première buse, dans lequel la capture de l'information de retour visuel en temps réel comporte la capture d'images fixes et d'images vidéo du premier fluide mis en jet par la première buse ; et

ajuster une pluralité de paramètres de formes d'onde de la première impulsion de pilotage forme à la première buse pour commander la mise en jet du premier fluide par la première buse sur la base de l'information de retour visuel en temps réel.

17. Procédé selon la revendication 16, **caractérisé en ce que** l'ajustement des paramètres de formes d'onde comporte d'au moins un niveau de tension, une vitesse de variation, une durée, une pluralité de segments, une fréquence et/ou la largeur de la première impulsion de pilotage fournie à la première buse.

18. Procédé selon la revendication 17, **caractérisé en ce que** l'ajustement des formes d'onde comporte de plus l'ajustement du niveau de tension de la première impulsion de pilotage par incréments.

19. Procédé selon la revendication 16, **caractérisé en ce que** l'ajustement des paramètres de formes d'onde comporte de plus l'ajustement des paramètres de formes d'onde d'une forme d'onde de mise en jet et d'une forme d'onde de non mise en jet.

20. Procédé selon la revendication 19, **caractérisé en ce** l'ajustement des paramètres de formes d'onde comporte de plus l'ajustement des paramètres de formes d'onde de la forme d'onde de non mise en jet en appliquant une impulsion de faible amplitude à la première buse pour déplacer le ménisque d'une goutte de fluide du premier fluide sans éjecter la goutte de fluide.

21. Procédé selon la revendication 16, **caractérisé en ce que** l'ajustement des paramètres de formes d'onde comporte de plus l'ajout ou la soustraction des segments de formes d'onde sur la première impulsion de pilotage.

22. Procédé selon la revendication 16, **caractérisé en ce que** la production de l'interface utilisateur en mode graphique comporte de plus la production d'un guide d'installation physique d'une cartouche de fluide au moyen d'une interface d'installation de cartouche de fluide ; la sélection d'un modèle à imprimer

prédéterminé en utilisant une interface de sélection de modèles à imprimer ; le chargement et/ou de déchargement d'un substrat en utilisant une interface de chargement et/ou de déchargement d'un substrat; et l'ajustement des réglages de cartouche au moyen d'une interface de réglage d'impression.

23. Procédé selon la revendication 16, **caractérisé en ce que** il comporte une unité de stockage pour stocker une pluralité d'impulsions de pilotage prédéterminées ; et dans lequel l'ajustement de la pluralité de formes d'onde comporte la sélection de la première impulsion de pilotage parmi la pluralité d'impulsion de pilotage prédéterminées stockées dans l'unité de stockage.

24. Procédé selon la revendication 22, **caractérisé en ce que** le chargement et/ou le déchargement d'un substrat comporte de plus l'ajustement d'une température de platine et l'épaisseur d'un substrat et l'activation ou la désactivation d'un vide de platine.

25. Procédé selon la revendication 22, **caractérisé en ce que** l'ajustement des réglages de cartouche comporte de plus l'ajustement de la température de cartouche.

26. Procédé selon la revendication 22, **caractérisé en ce que** l'ajustement des réglages de cartouche comporte de plus la création ou l'ajustement d'au moins un cycle de nettoyage pour exécuter la maintenance de la première buse.

27. Procédé selon la revendication 22, **caractérisé en ce que** l'ajustement des réglages de cartouche comporte de plus l'édition de modèles prédéterminés d'impression et/ou la création d'un nouveau modèle d'impression.

28. Procédé selon la revendication 27, **caractérisé en ce que** l'édition de modèles prédéterminés d'impression et/ou la création d'un nouveau modèle d'impression comportent de plus l'ajustement d'au moins une hauteur de substrat, une largeur de substrat, une coordonnée X de démarrage de bloc de modèle, une coordonnée Y de démarrage de bloc de modèle, une hauteur de bloc de modèle, une largeur de bloc de modèle, une coordonnée X de démarrage de goutte pour un bloc de modèle, une coordonnée Y de démarrage de goutte pour un bloc de modèle, , une hauteur de position pour un bloc de modèle et une largeur de position pour un bloc de modèle.

29. Procédé selon la revendication 16, **caractérisé en ce qu'**il comporte de plus : appliquer une deuxième impulsion de pilotage sur une deuxième buse pour affecter la mise en jet d'un deuxième fluide par la deuxième buse ;

capturer une information de retour visuel en temps réel du deuxième fluide qui est éjectée par la deuxième buse, dans lequel la capture de l' information de retour visuel en temps réel comporte la capture d'images fixes et d'images vidéo du deuxième fluide mis en jet par la deuxième buse ; et

ajuster une pluralité de paramètres de formes d'onde de la deuxième impulsion de pilotage forme à la deuxième buse pour commander la mise en jet du deuxième fluide par la deuxième buse sur la base de l'information de retour visuel en temps réel.

30. Produit sous forme d'un programme d'ordinateur encodé sur un support lisible par ordinateur, et fonctionnant de manière à provoquer l'exécution par un appareil de traitement de donnée d'opérations comprenant :

exécuter une interface utilisateur en mode graphique sur un système d'ordinateurs, l'interface utilisateur en mode graphique étant configuré pour commander des paramètres de formes d'onde qui affectent la mise en jet de fluides au moyen d'une pluralité de buses ;

appliquer une première impulsion de pilotage sur une première buse pour affecter la mise en jet d'un premier fluide par la première buse ;

capturer une information de retour visuel en temps réel du premier fluide qui est éjectée par la première buse, dans lequel la capture de l'information de retour visuel en temps réel comporte la capture d'images fixes et d'images vidéo du premier fluide mis en jet par la première buse ; et

ajuster une pluralité de paramètres de formes d'onde de la première impulsion de pilotage forme à la première buse pour commander la mise en jet du premier fluide par la première buse sur la base de l'information de retour visuel en temps réel.

31. Produit selon la revendication 30, **caractérisé en ce qu'**il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement d'au moins un niveau de tension, une vitesse de variation, une durée, une pluralité de segments, une fréquence et/ou la largeur de la première impulsion de pilotage fournie à la première buse.

32. Produit selon la revendication 30, **caractérisé en ce qu'**il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement du niveau de tension de la première impulsion de pilotage appliquée par la première buse par incréments.

33. Produit selon la revendication 30, **caractérisé en ce qu'**il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement des paramètres de formes d'onde d'une forme d'onde de mise en jet et d'une forme d'onde de non mise en jet de la première impulsion de pilotage.

34. Produit selon la revendication 33, **caractérisé en ce qu'**il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement des paramètres de formes d'onde de la forme d'onde de non mise en jet en appliquant une impulsion de faible amplitude à la première buse pour déplacer le ménisque d'une goutte de fluide du premier fluide sans éjecter la goutte de fluide.

35. Produit selon la revendication 30, **caractérisé en ce qu'**il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajout ou la soustraction de segments de formes d'onde sur la première impulsion de pilotage.

36. Produit selon la revendication 30, **caractérisé en ce qu'**il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant : la production d'un guide d'installation physique d'une cartouche de fluide au moyen d'une interface d'installation de cartouche de fluide ; la sélection d'un modèle à imprimer prédéterminé en utilisant une interface de sélection de modèles à imprimer ; le chargement et/ou de déchargement d'un substrat en utilisant une interface de chargement et/ou de déchargement d'un substrat; et l'ajustement des réglages de cartouche au moyen d'une interface de réglage d'impression.

37. Produit selon la revendication 30, **caractérisé en ce que** il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant le stockage d'une pluralité d'impulsions de pilotage prédéterminées ; la sélection de la première impulsion de pilotage parmi la pluralité d'impulsion de pilotage prédéterminées stockées dans l'unité de stockage.

38. Produit selon la revendication 36, **caractérisé en ce que** il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement d'une température de platine et l'épaisseur d'un substrat et l'activation ou la désactivation d'un vide de platine.

39. Produit selon la revendication 36, **caractérisé en ce que** il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement des réglages de cartouche comportant l'ajustement d'une température de cartouche.

40. Produit selon la revendication 36, **caractérisé en ce que** il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement des réglages de cartouche comportant la création ou l'ajustement d'au moins un cycle de nettoyage pour exécuter la maintenance de la première buse.

41. Produit selon la revendication 36, **caractérisé en ce que** il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'ajustement des réglages de cartouche comportant de plus l'édition de modèles prédéterminés d'impression et/ou la création d'un nouveau modèle d'impression.

42. Produit selon la revendication 37, **caractérisé en ce que** il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant l'édition de modèles prédéterminés d'impression et/ou la création d'un nouveau modèle d'impression comportent de plus l'ajustement d'au moins une hauteur de substrat, une largeur de substrat, une coordonnée X de démarrage de bloc de modèle, une coordonnée Y de démarrage de bloc de modèle, une hauteur de bloc de modèle, une largeur de bloc de modèle, une coordonnée X de démarrage de goutte pour un bloc de modèle, une coordonnée Y de démarrage de goutte pour un bloc de modèle, une hauteur de position pour un bloc de modèle et une largeur de position pour un bloc de modèle.

43. Produit selon la revendication 37, **caractérisé en ce que** il fonctionne de plus pour permettre à l'appareil de traitement de données d'exécuter des opérations comprenant : appliquer une deuxième impulsion de pilotage sur une deuxième buse pour affecter la mise en jet d'un deuxième fluide par la deuxième buse ; capturer une information de retour visuel en temps réel du deuxième fluide qui est éjectée par la deuxième buse, dans lequel la capture de l'information de retour visuel en temps réel comporte la capture d'images fixes et d'images vidéo du deuxième fluide mis en jet par la deuxième buse ; et ajuster une pluralité de paramètres de formes d'onde de la deuxième impulsion de pilotage forme à la deuxième buse pour commander la mise en jet du deuxième fluide par la deuxième buse sur la base de l'information de retour visuel en temps réel.

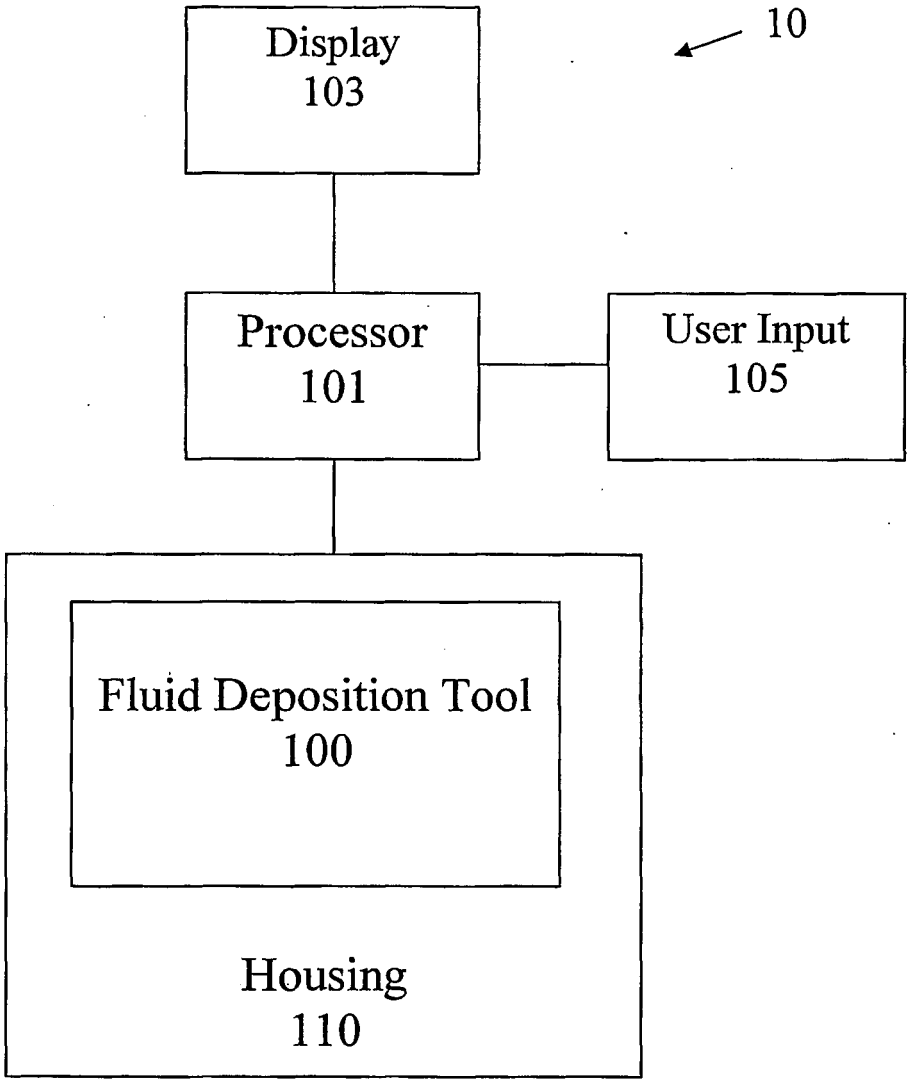

Display
103
10
Processor
101
User Input
105
Fluid Deposition Tool
100
Housing
110

FIG. 1

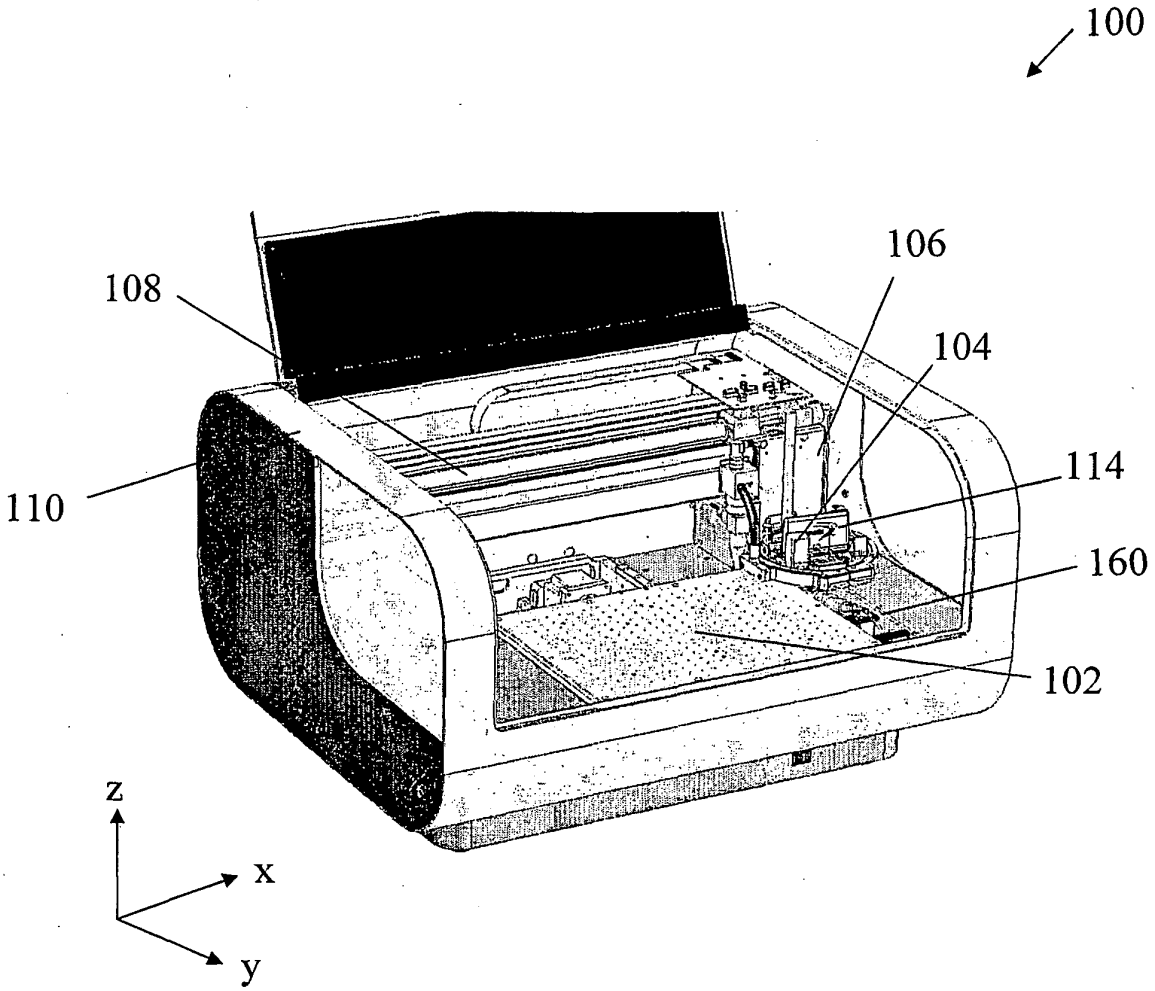


FIG. 2

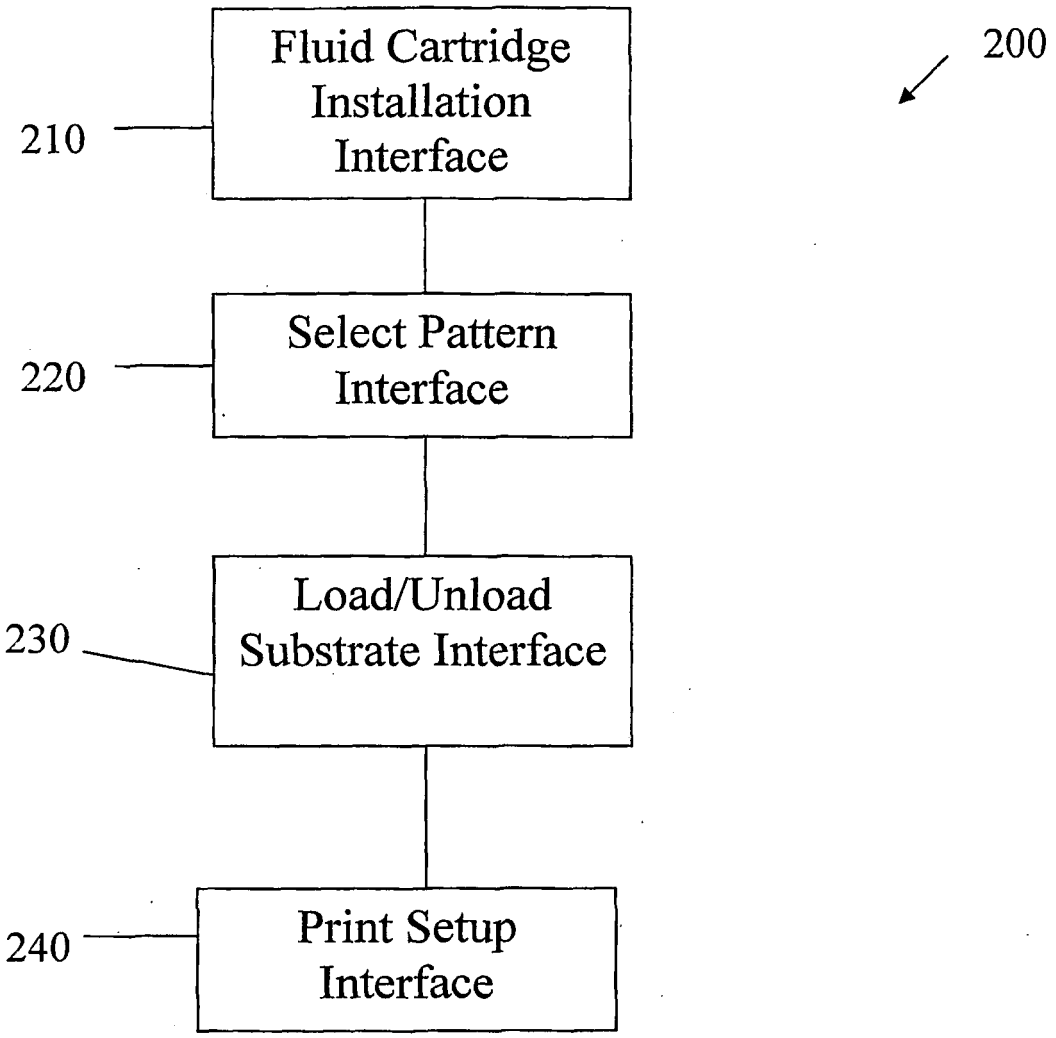

200
Fluid Cartridge Installation Interface
210
Select Pattern Interface
220
Load/Unload Substrate Interface
230
Print Setup Interface
240

FIG. 3

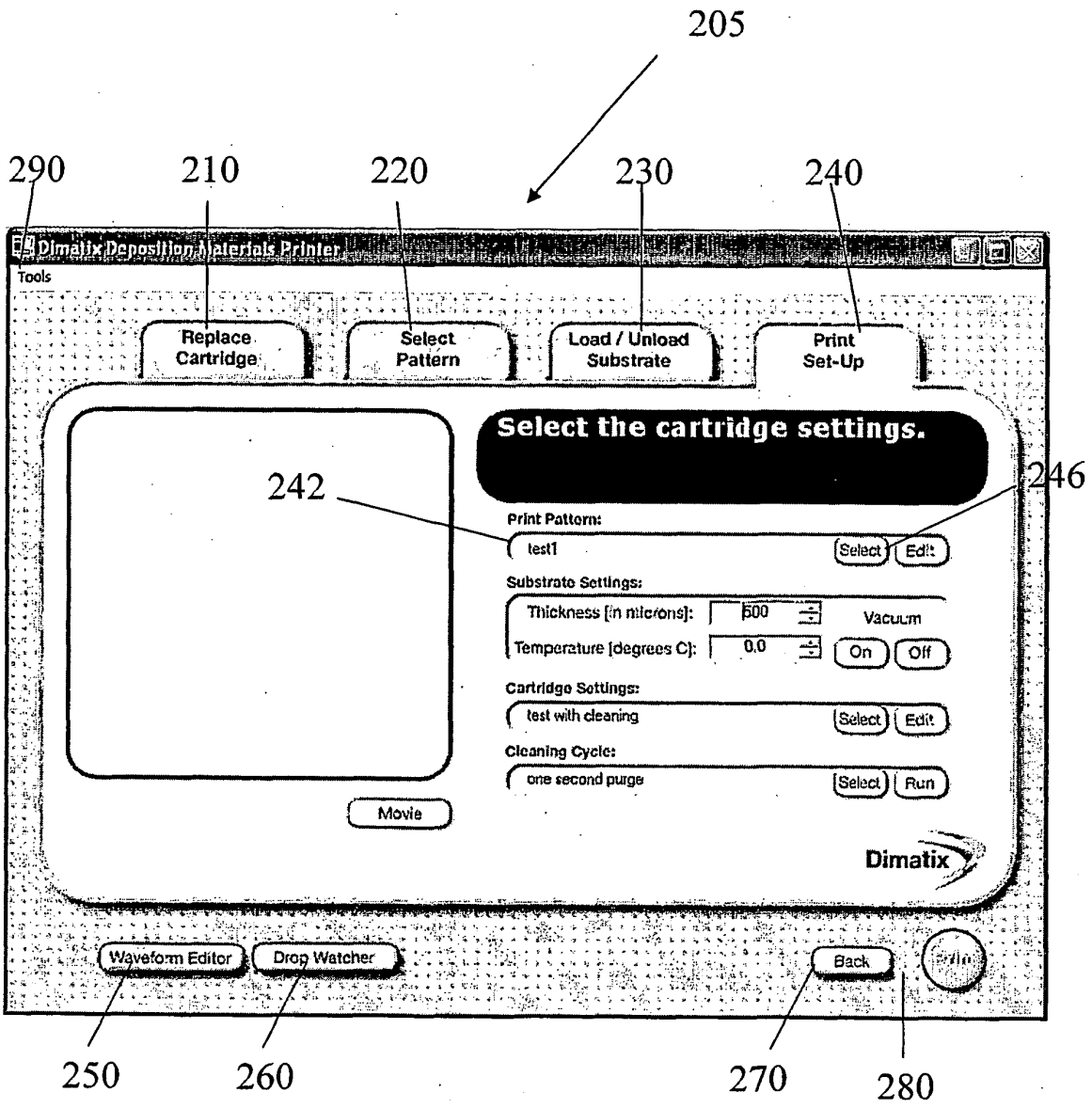

205
290
210
220
230
240
Dimatix Deposition Materials Printer
Tools
Replace Cartridge
Select Pattern
Load / Unload Substrate
Print Set-Up
Select the cartridge settings.
242
246
Print Pattern:
test1
Select
Edit
Substrate Settings:
Thickness [in microns]:
500
Vacuum
Temperature [degrees C]:
0.0
On
Off
Cartridge Settings:
test with cleaning
Select
Edit
Cleaning Cycle:
one second purge
Select
Run
Movie
Dimatix
Waveform Editor
Drop Watcher
Back
250
260
270
280

FIG .4

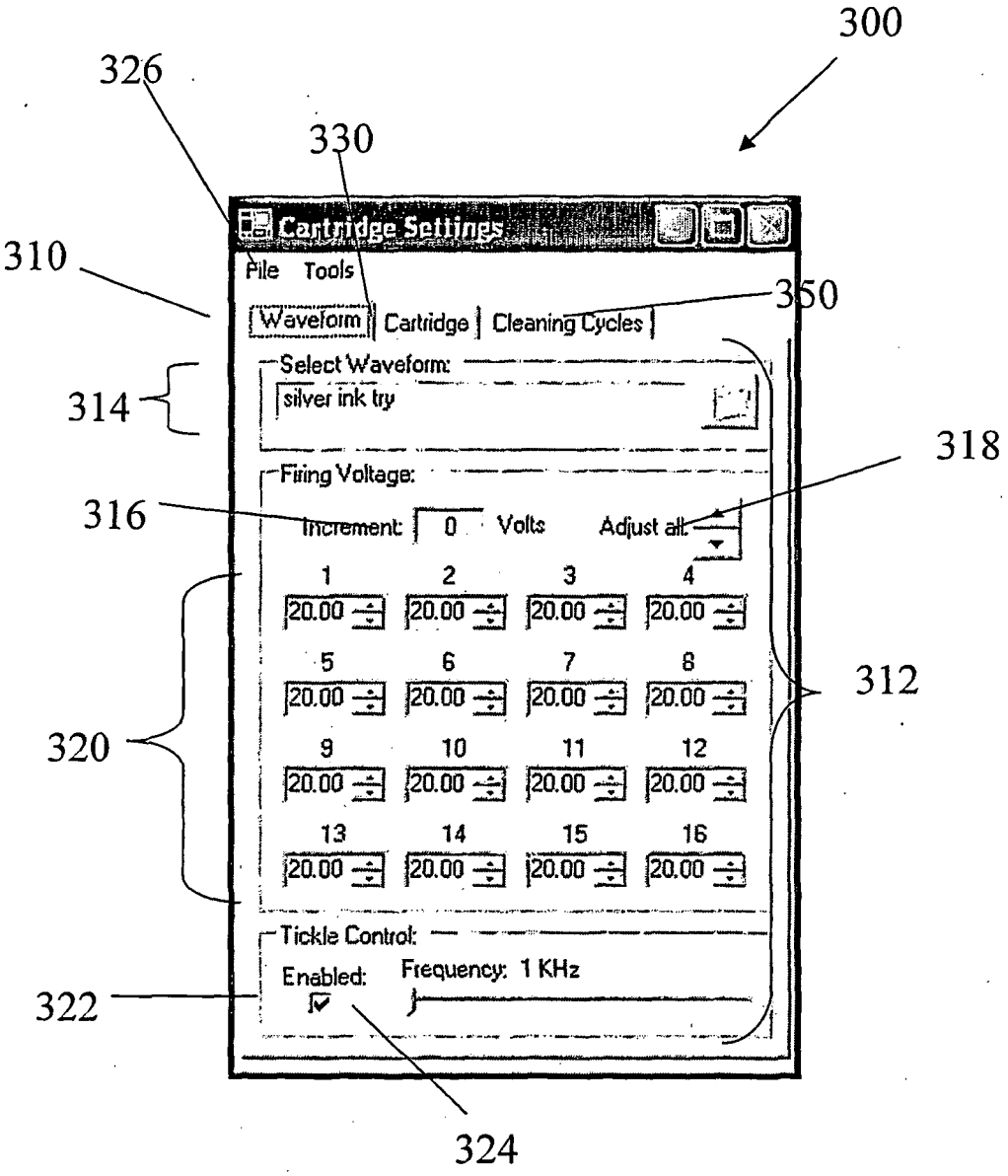

300
326
330
310
350
314
318
316
312
320
322
324
Cartridge Settings
File Tools
Waveform
Cartridge
Cleaning Cycles
Select Waveform:
silver ink try
Firing Voltage:
Increment: 0 Volts
Adjust all:
1 2 3 4
20.00 20.00 20.00 20.00
5 6 7 8
20.00 20.00 20.00 20.00
9 10 11 12
20.00 20.00 20.00 20.00
13 14 15 16
20.00 20.00 20.00 20.00
Tickle Control:
Enabled:
Frequency: 1 KHz

FIG. 5

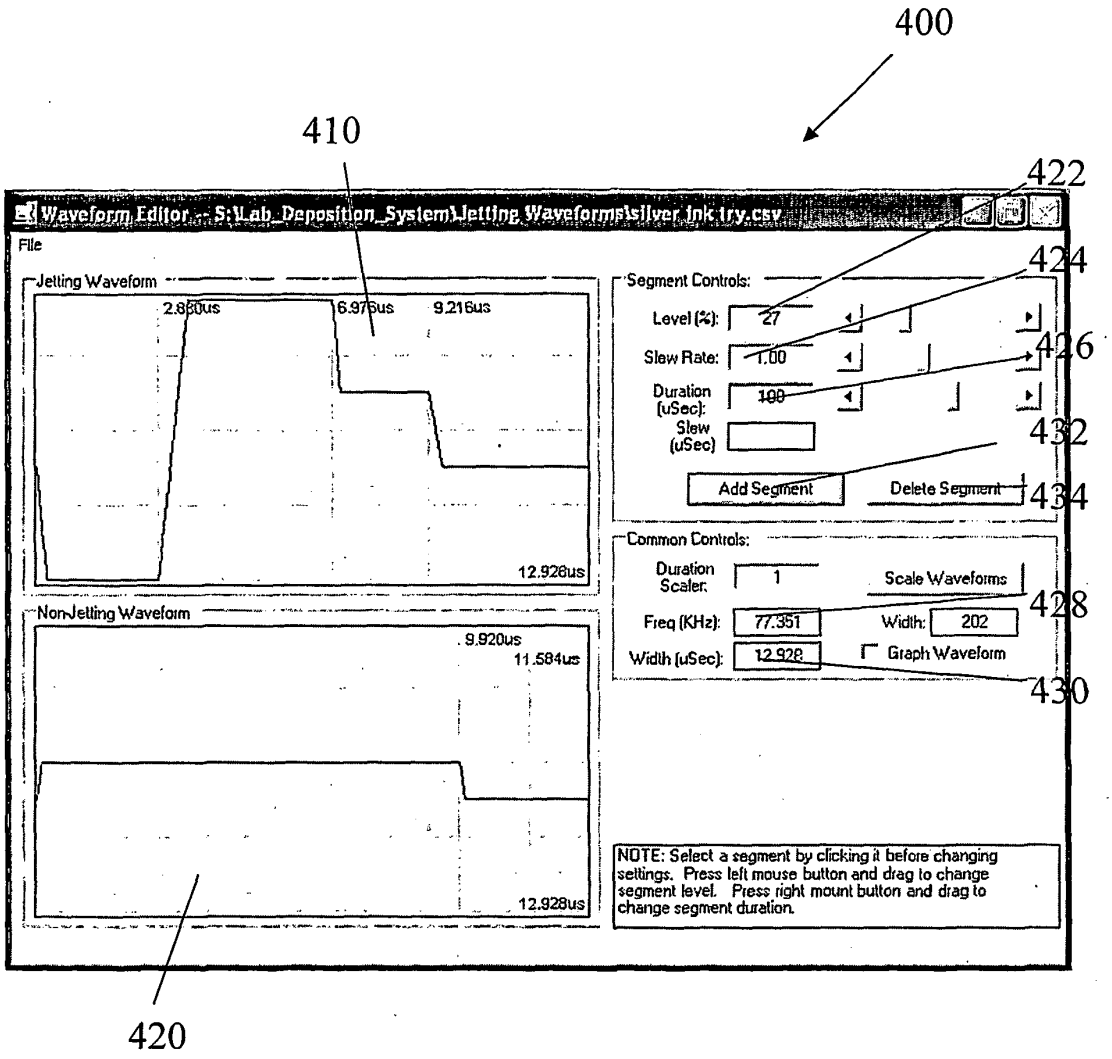

400
410
422
424
426
432
434
428
430
420
Waveform Editor - S:\Lab_Deposition_System\Jetting Waveforms\silver_ink try.csv
File
Jetting Waveform
2.880us
6.976us
9.216us
12.928us
NonJetting Waveform
9.920us
11.584us
12.928us
Segment Controls:
Level (%):
27
Slew Rate:
1.00
Duration (uSec):
100
Slew (uSec)
Add Segment
Delete Segment
Common Controls:
Duration Scaler:
1
Scale Waveforms
Freq (KHz):
77.351
Width:
202
Width (uSec):
12.928
Graph Waveform
NOTE: Select a segment by clicking it before changing settings. Press left mouse button and drag to change segment level. Press right mount button and drag to change segment duration.

FIG. 6

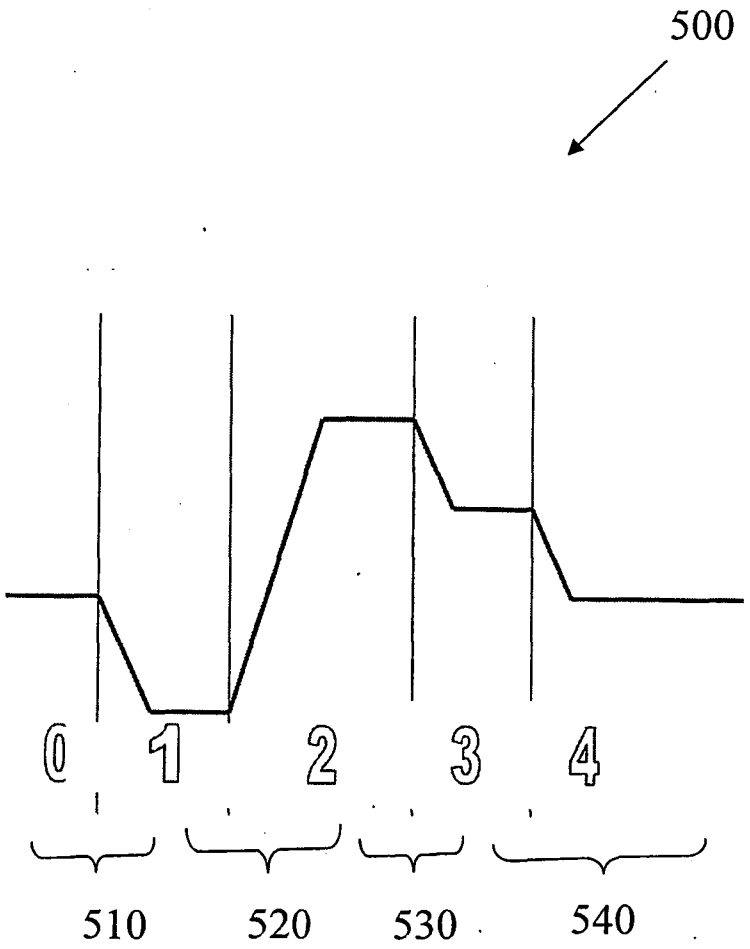


FIG. 7

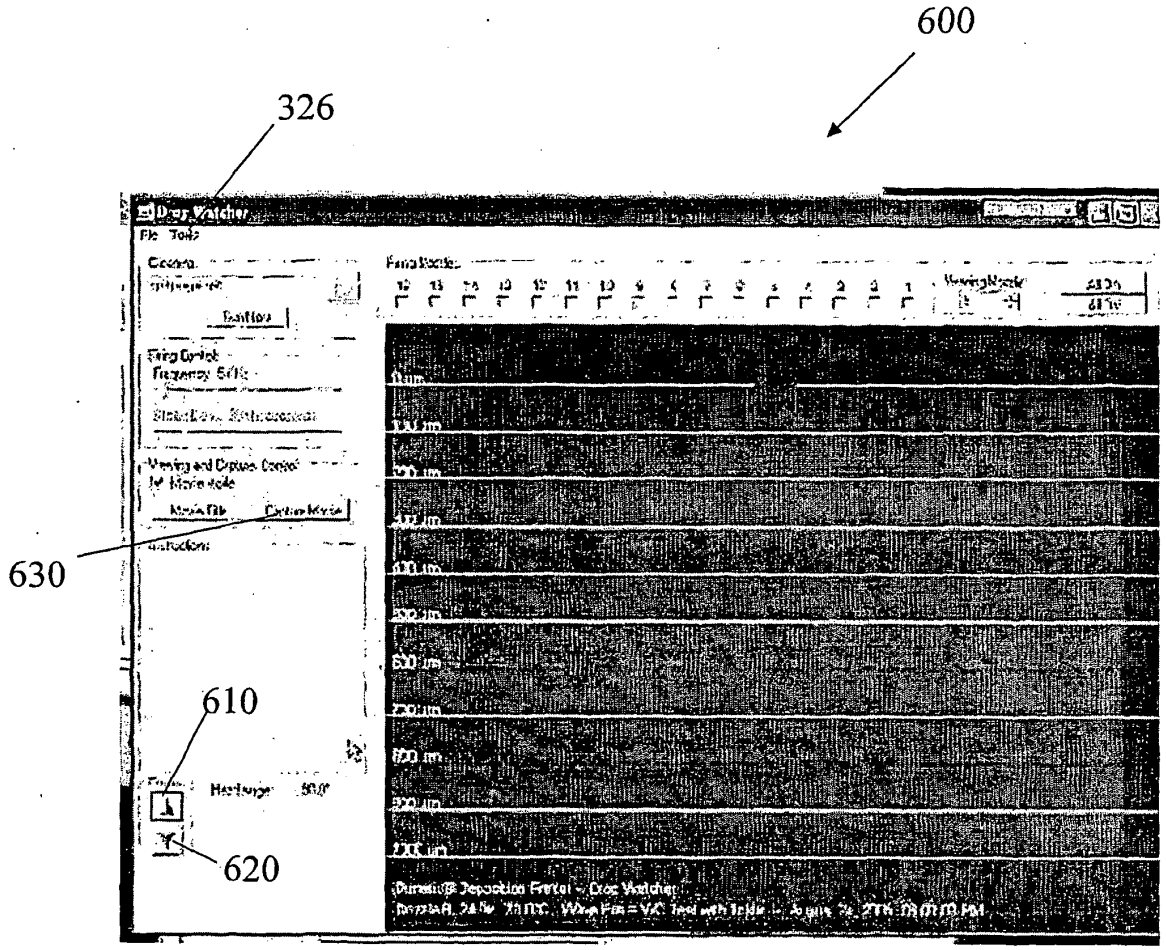


FIG. 8

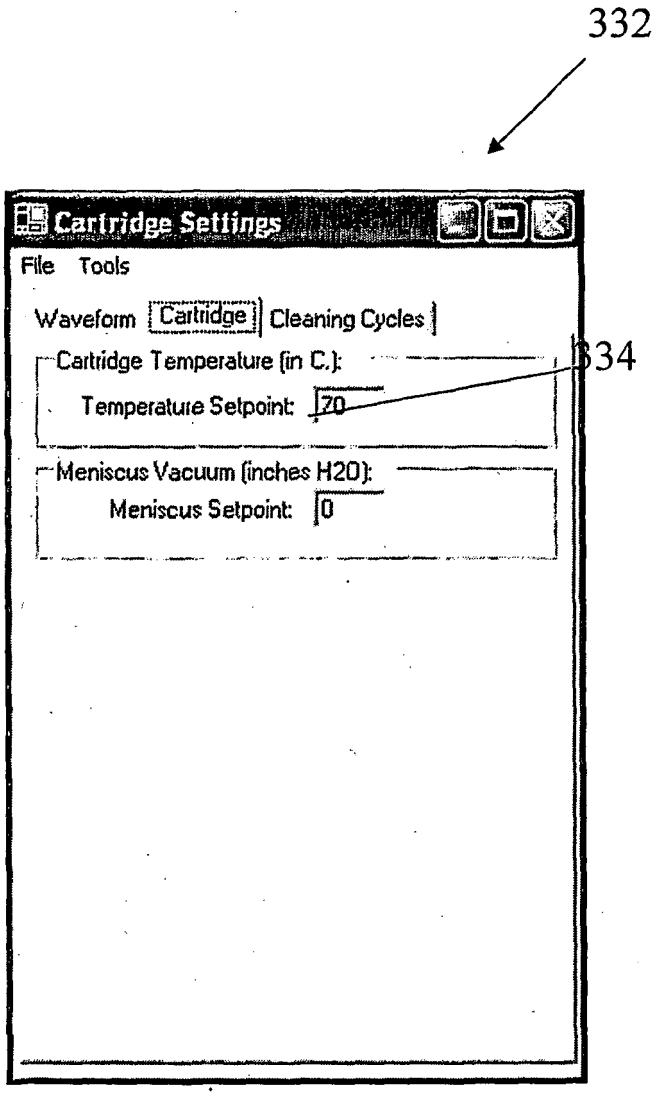

332
Cartridge Settings
File Tools
Waveform Cartridge Cleaning Cycles
Cartridge Temperature (in C.):
Temperature Setpoint: 70
334
Meniscus Vacuum (inches H20):
Meniscus Setpoint: 0

FIG. 9

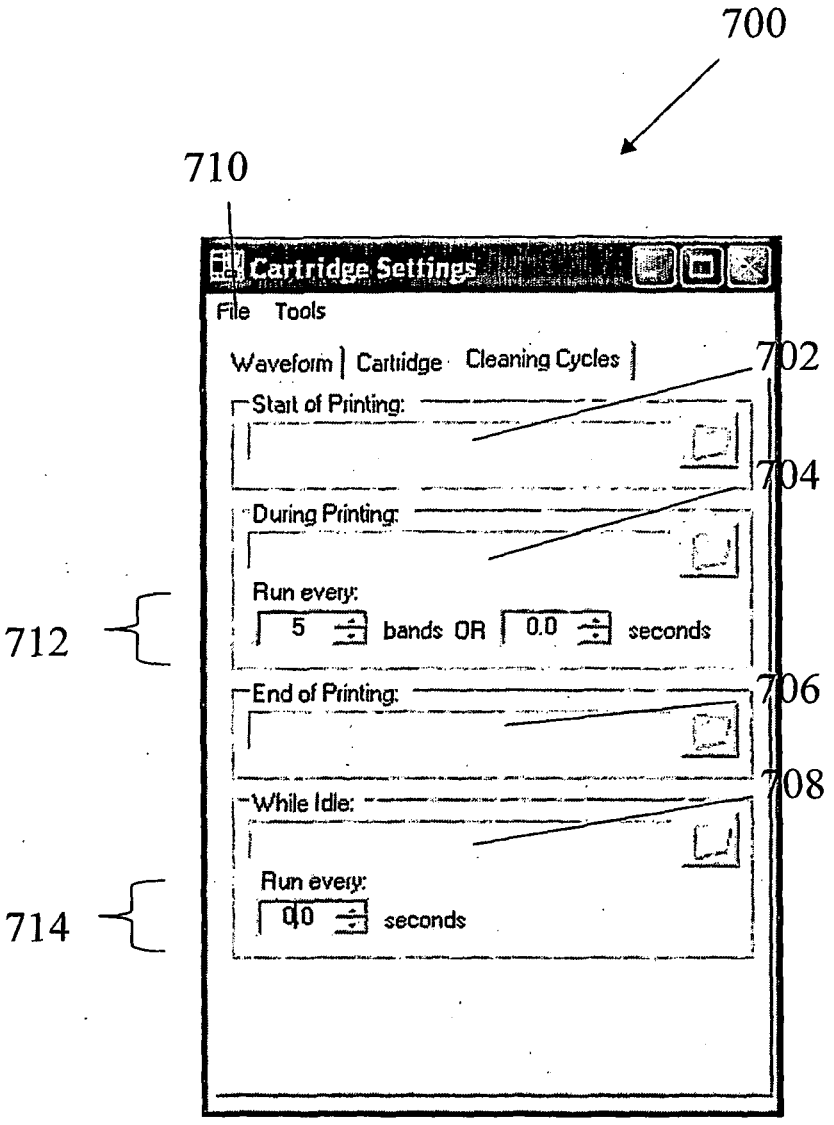

700
710
Cartridge Settings
File Tools
Waveform | Cartridge | Cleaning Cycles |
702
Start of Printing:
704
During Printing:
Run every:
5 bands OR 0.0 seconds
712
End of Printing:
706
While Idle:
708
Run every:
0.0 seconds
714

FIG. 10

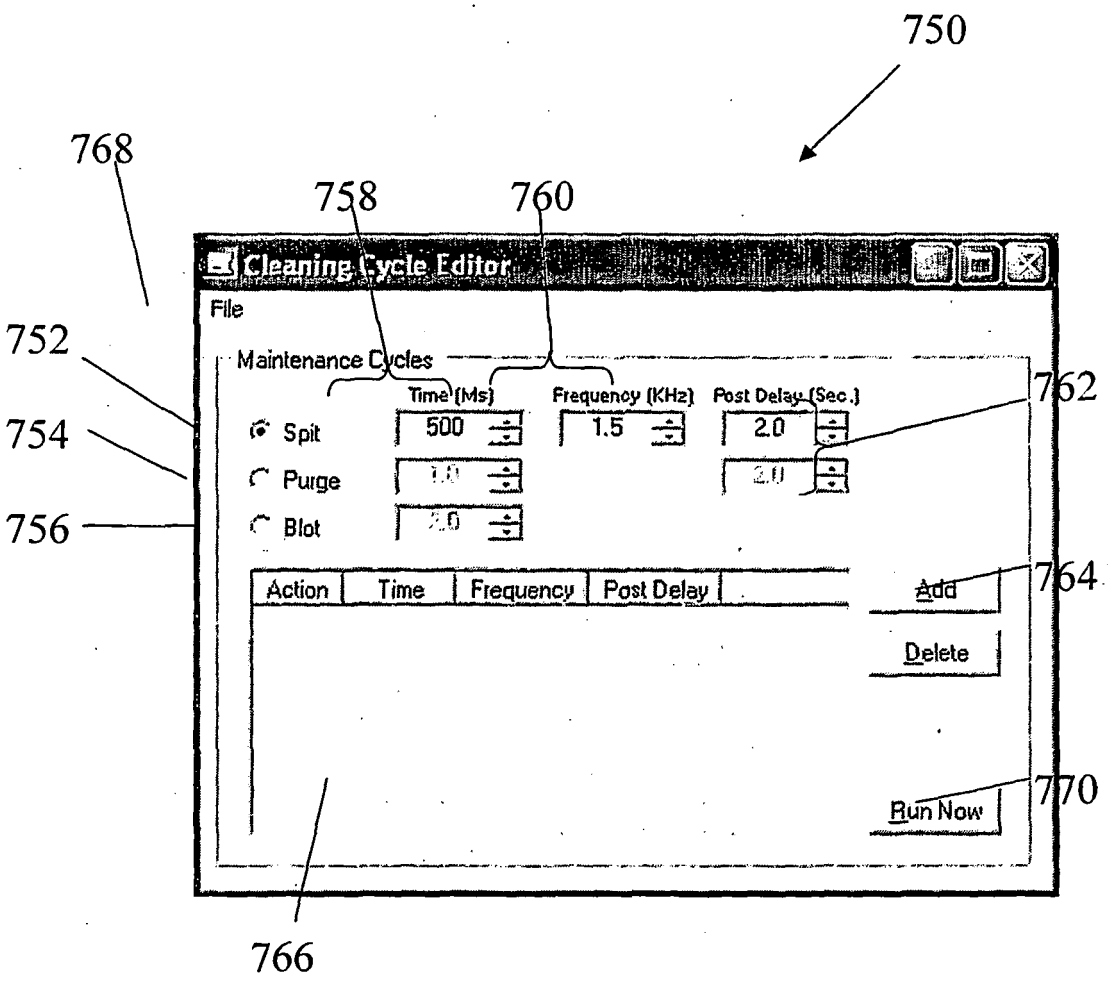

750
768
758
760
Cleaning Cycle Editor
File
752
Maintenance Cycles
Time (Ms)
Frequency (KHz)
Post Delay (Sec.)
762
754
Spit
500
1.5
2.0
Purge
756
Blot
Action
Time
Frequency
Post Delay
Add
764
Delete
Run Now
770
766

FIG. 11

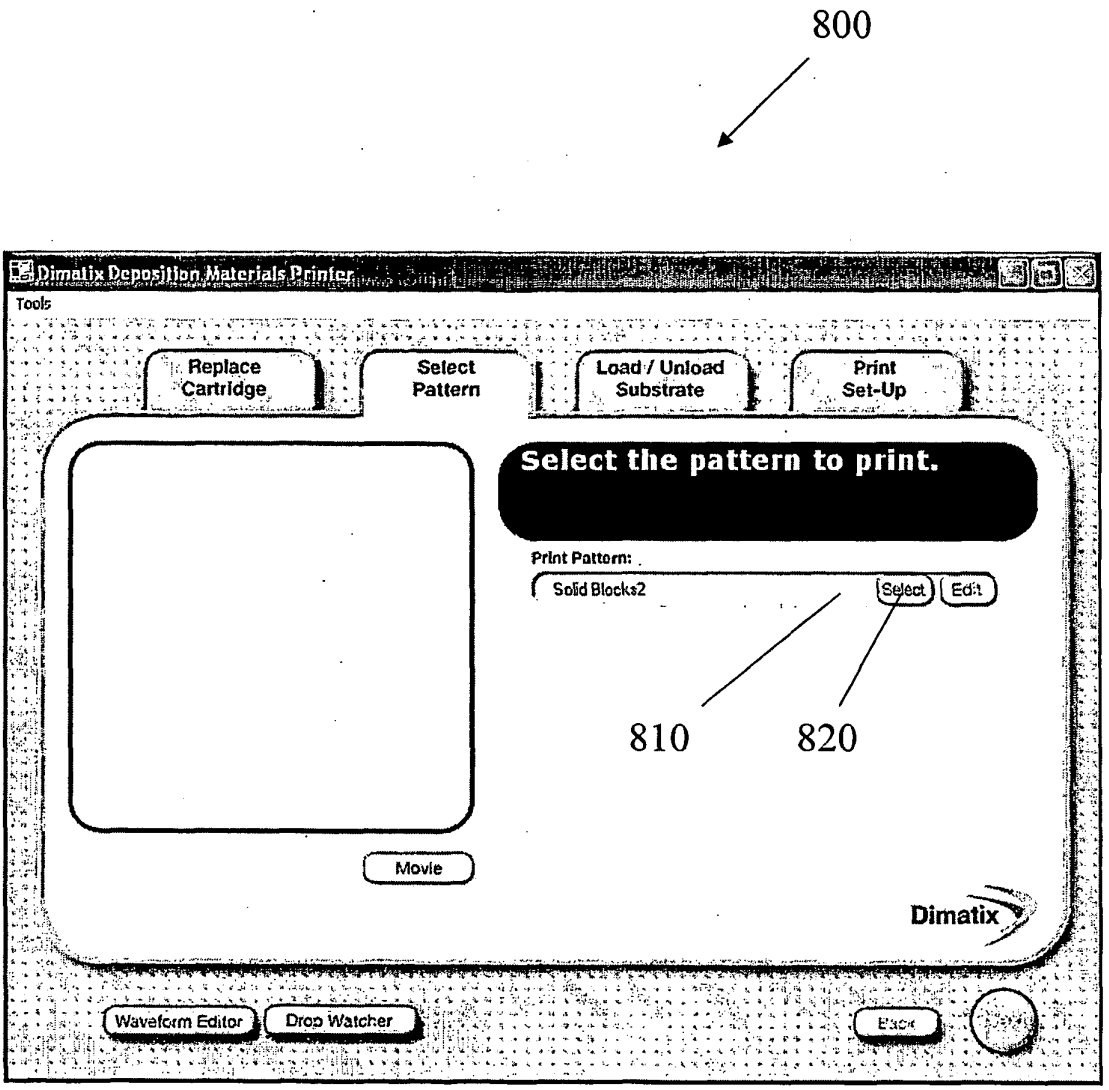

800
Dimatix Deposition Materials Printer
Tools
Replace Cartridge
Select Pattern
Load / Unload Substrate
Print Set-Up
Select the pattern to print.
Print Pattern:
Solid Blocks2
Select
Edit
810
820
Movie
Dimatix
Waveform Editor
Drop Watcher
Back

FIG. 12

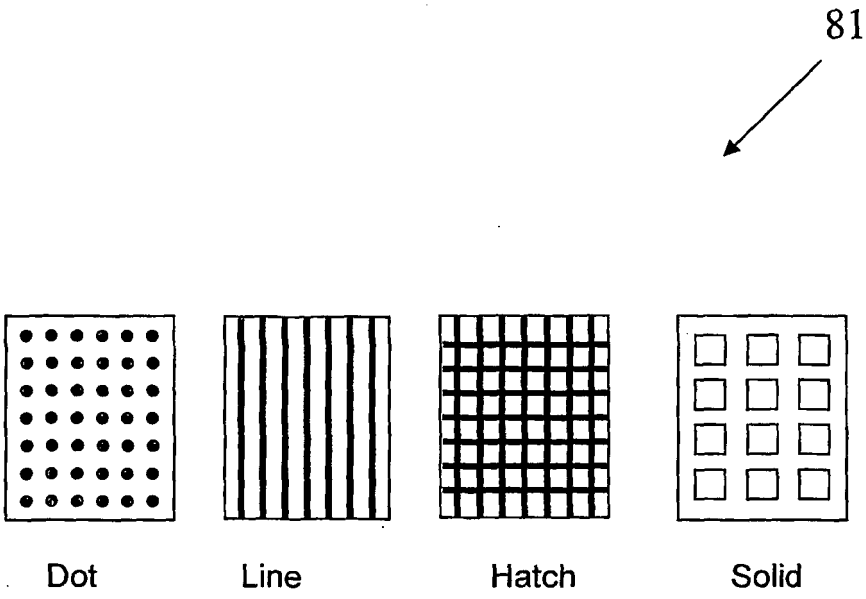


FIG. 13

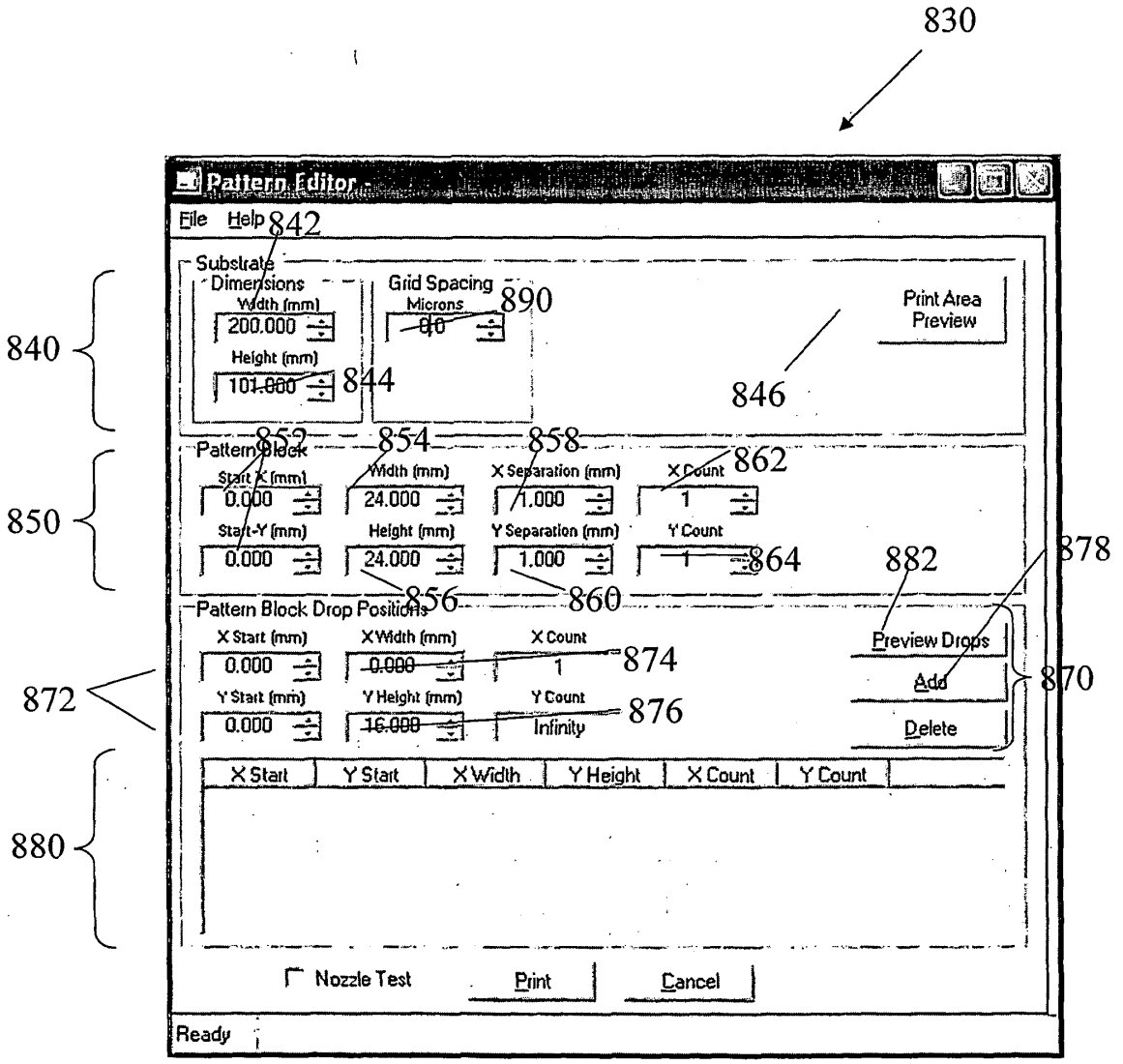

830
Pattern Editor
File Help
842
Substrate
Dimensions
Width (mm)
200.000
Height (mm)
101.000
844
Grid Spacing
Microns
890
Print Area Preview
846
840
Pattern Block
852
854
858
862
Start X (mm)
0.000
Width (mm)
24.000
X Separation (mm)
1.000
X Count
1
Start Y (mm)
0.000
Height (mm)
24.000
Y Separation (mm)
1.000
Y Count
1
864
850
882
878
856
860
Pattern Block Drop Positions
X Start (mm)
0.000
X Width (mm)
0.000
X Count
1
874
Preview Drops
Add
Delete
870
Y Start (mm)
0.000
Y Height (mm)
16.000
Y Count
Infinity
876
872
X Start
Y Start
X Width
Y Height
X Count
Y Count
880
Nozzle Test
Print
Cancel
Ready

FIG. 14

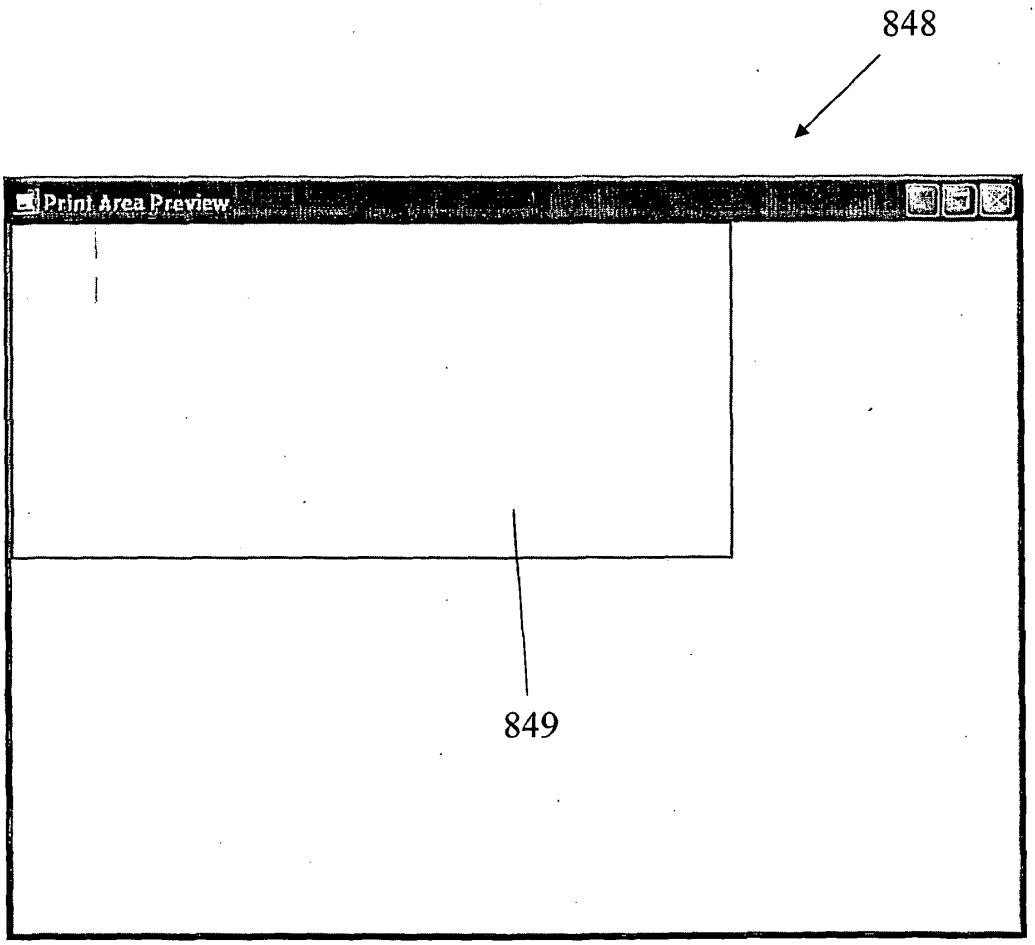


FIG. 15

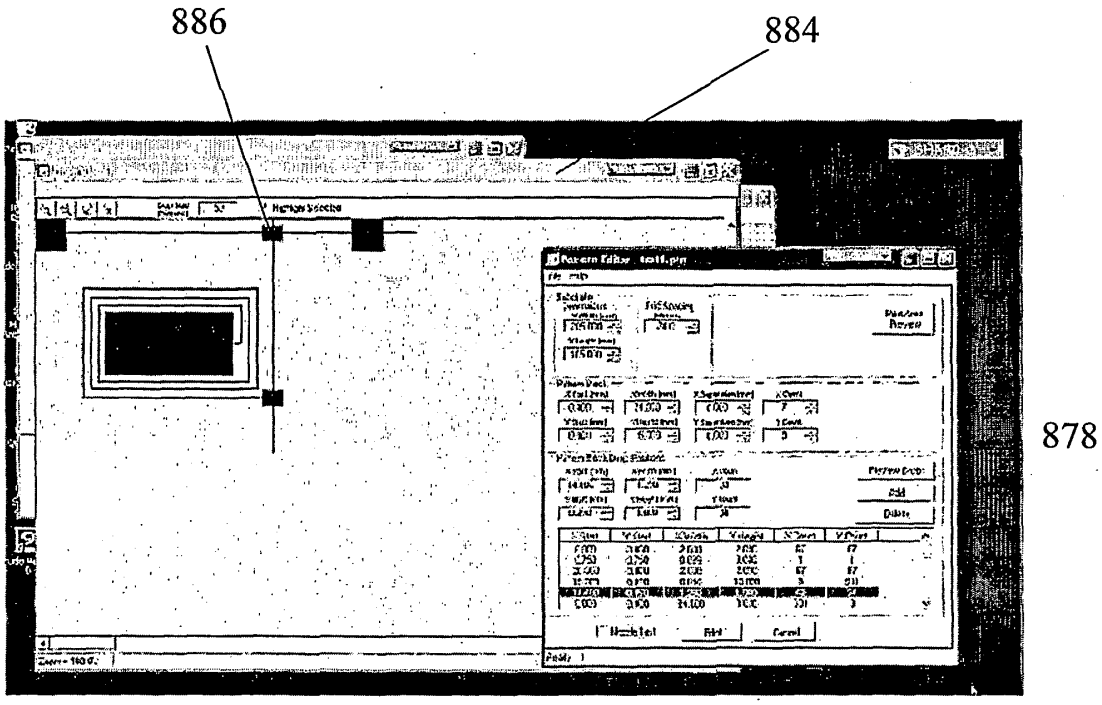


FIG. 16

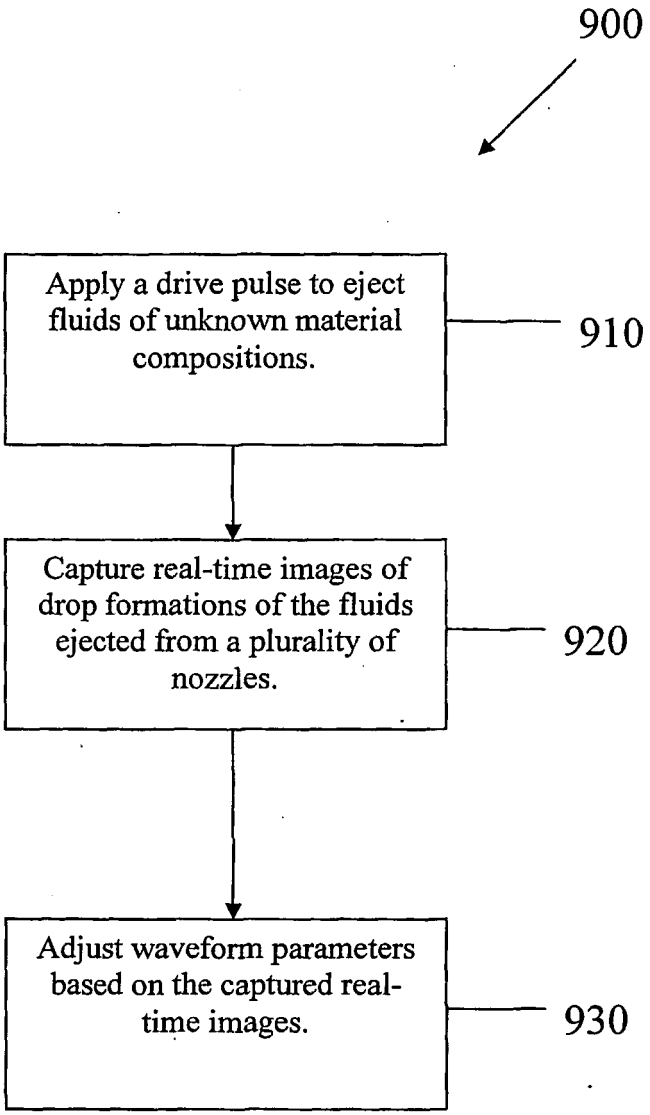

900
Apply a drive pulse to eject fluids of unknown material compositions.
910
Capture real-time images of drop formations of the fluids ejected from a plurality of nozzles.
920
Adjust waveform parameters based on the captured real-time images.
930

FIG. 17

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5265315 A, Hoisington **[0004]**
- US 6094280 A **[0005]**